Oct 1948

Editorial

AUSTRALIA is still remembering the tragic aircraft smash in the wild country of New South Wales.

As we go to press, no one knows exactly why it happened. We know that the weather was bad, that the aircraft was a long way off course, that it crashed apparently without warning a few minutes after its last check with Sydney, and that all the passengers and crew lost their lives.

We suspect that the pilot was relying on his radio compass for direction, and tuned in to the wrong station through a mix-up over changed wavelengths. It may be that he left the safety of the radio beam in order to make up time or to evade the worst of the weather. We'll probably never know for sure. The penalty of circumstances and accident have seen to that. All we do know is that the mangled mass of a fine aeroplane was found on a mountain top a few feet short of a safe crossing.

Flying can be a treacherous business. Anyone who has made a trip between the various cities in clear sunlight will wonder how a pilot could possibly lose his way. Even on a cloudless night, the steady progress from city to city is marked by a succession of town lights and beacons that make flying as easy as pie.

A few hours later, maybe, clouds have moved over, rain is falling, visibility is nil. Our easy, panoramic passage now becomes a matter of instrument flying, judgment, checking and cross checking. And if something goes wrong, so much can happen in so short a time.

Australia is a country where air travel is a "must." We cannot hope to develop and maintain communications without it. We are obliged to use the air if we are to keep pace with the present, and make possible our great future. We must make the air safe.

Radar can do this. It can show a map to the pilot which is as reliable as a visual sighting. Darkness and fog do not affect it. With Radar, the Lutana could have followed the coast line to Sydney as though it were daylight.

Radar equipment at the airport could have shown the exact position of the aircraft just as easily. The pilot could have been told where he was, even if he himself was in doubt.

We understand that equipment is about to be installed which will improve the present position. This is good news. Flying in Australia must be made absolutely safe. A clean sheet is not a matter for congratulation. It must be the order of the day.

John Moyle

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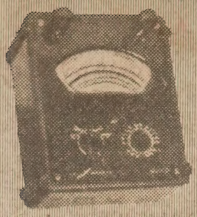

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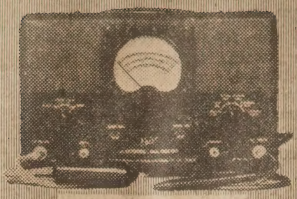

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Probe type
Vacuum Tube Multimeter

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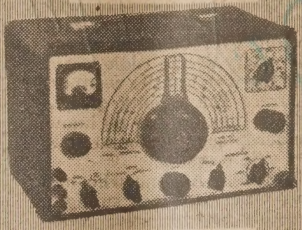
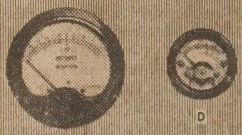
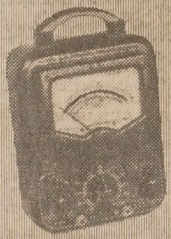


Signal Generator
150 Kc. to 30 Mc.





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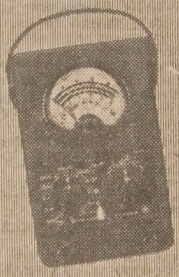

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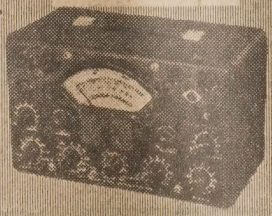

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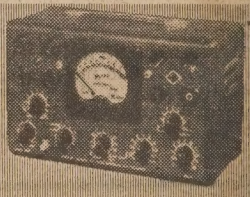

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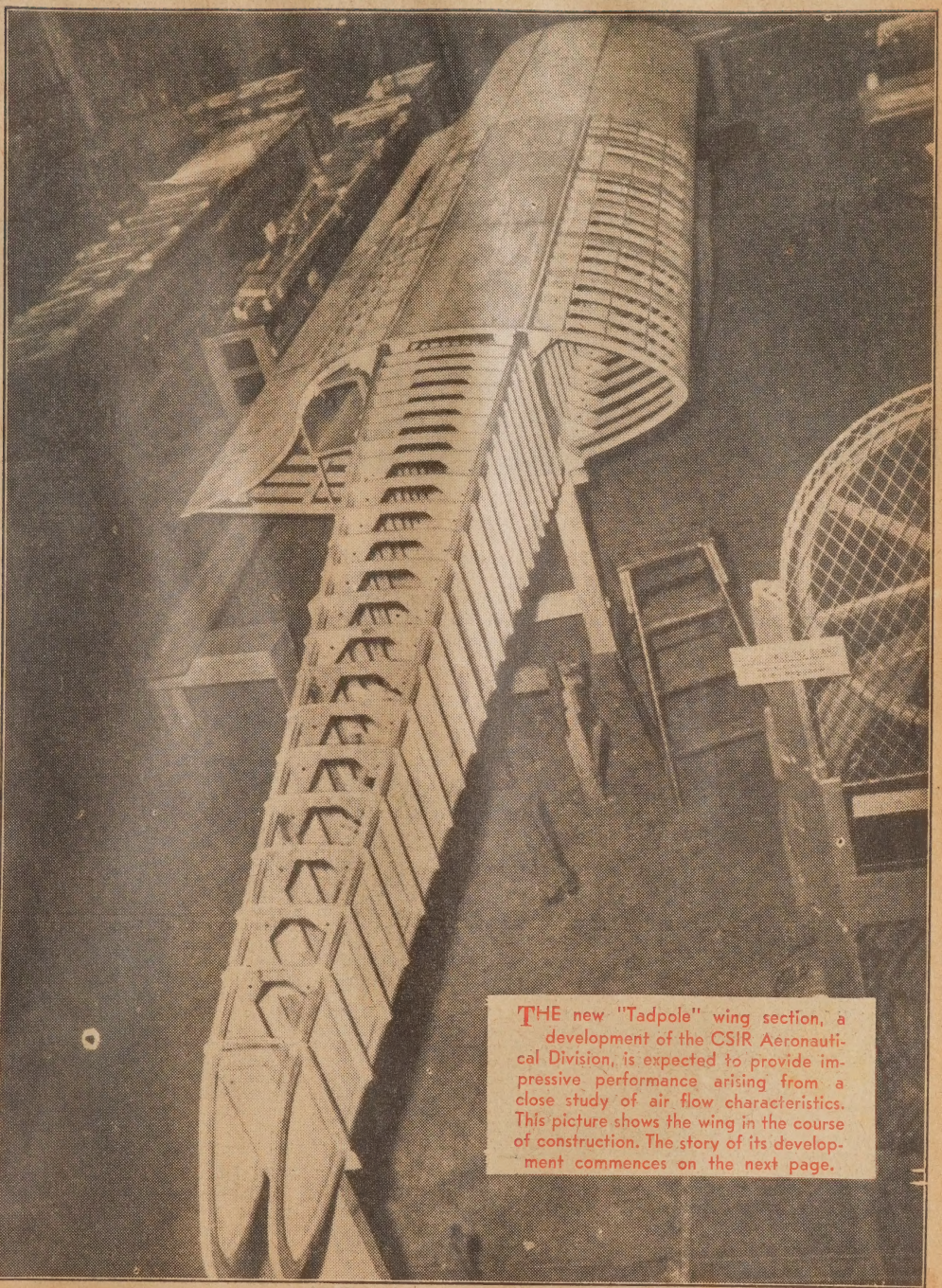
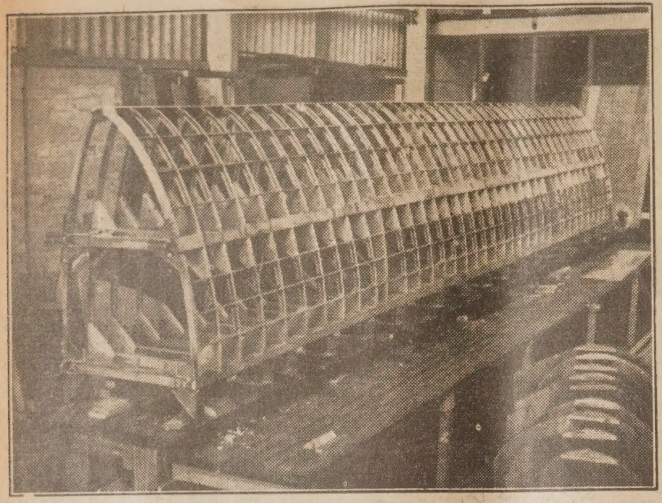
P22 F.P.

A NEW AUSTRALIAN WING SECTION



THE new "Tadpole" wing section, a development of the CSIR Aeronautical Division, is expected to provide impressive performance arising from a close study of air flow characteristics. This picture shows the wing in the course of construction. The story of its development commences on the next page.

GREAT HOPES FOR TADPOLE WING



Early stage in construction of the tadpole wing — assembly of nose torsion box ribs of the centre section.

Within a few weeks, Group-Captain D. R. Cuming, the RAAF's most experienced test pilot, will undertake the first flight trials to discover the flying behavior of the new "boundary layer suction wing," which has been designed by the Aeronautics Division of the Council for Scientific and Industrial Research and built in Melbourne by the Division of Aircraft Production.

REPRESENTING a revolutionary concept of wing-section design, the "suction wing" first took shape on the drawing boards of the Aeronautics Division just over two years ago. Preliminary experiments with wind-tunnel test models have been going on for the past 18 months, resulting in refinement and development of the original design.

The wing is characterised by the great thickness of its section and by the way in which its upper outline sweeps sharply downward at a point behind the thickest section, which is halfway along the chord (that is, halfway between the wing's leading and trailing edges).

SUCTION SLOTS

Just below the point where the line of the wing's upper surface sweeps downward, a series of suction slots has been introduced. These slots are connected to a suction motor inside the wing with the idea of drawing into the wing the flow of air that normally breaks away and sets up turbulence, resulting in drag.

Aeronautical experts have long been seeking a means of cutting down turbulence and maintaining a smooth flow of air around the wing.

First public announcement that a new type of wing had been evolved came in July last, when Sir Ben Lockspeiser, chief scientist for the British Ministry of Supply, returned to London after his Australian visit. He gave full credit to our scientists and technicians for the initiative and ability that have been displayed in the development of this product of Australian research, design and engineering.

It was Sir Ben Lockspeiser who gave the new wing the aptly descriptive title by which it has become generally known — the "tadpole wing." And because the wing in section does resemble closely the outline of a tadpole, the name is certain to remain. Officially the wing is known as the GLAS II, or low-drag aerofoil.

A considerable amount of laboratory development on the suction wing was undertaken in England, but the stage of flight testing was not reached. At the meeting of the Commonwealth Advisory Aeronautical Research Council held in London in June, 1946, flight development of the new suction wing was allocated to Australia. The work involved included a lot of fundamental research and development.

by R. Michel

Responsibility for the project was accepted by the Division of Aeronautics of CS & IR, located at Fishermen't Bend, Melbourne, and the preliminary work of research and small-scale testing has been proceeding.

Now a stage has been reached where the theory can be put to its first flight test.

A glider wing incorporating the suction principle has been built of Australian timbers by the Supply Department's Division of Aircraft Production, also located at Fishermen's Bend. The wing is 56ft. in span and 2ft. 6in. at the point of its greatest thickness. It is fitted to a standard de Havilland six-passenger DH-G2 glider.

The fuselage of the glider has been modified internally to incorporate the suction plant and instruments for making flight observation. A specially-designed centrifugal fan driven by a V-8 motor will provide the suction.

The surface of the wing has been given the smoothest "finish" possible in order to reduce skin friction to a minimum.

Flight-testing will be undertaken at Point Cook (Victoria), the RAAF's principal station for performance trials. The testing will be in the hands of Group-Captain Cuming, who made the initial test flights with the first Australian-built Lincoln, and with the RAAF's new Vampire and Meteor jets.

TOWING CHECKS

Before the glider takes the air, checks will be made by having it towed behind motor trucks at speeds of about 40 miles an hour in order that the pilot may find out some of the quirks of the new aerofoil. Experience will be gained, too, in the adjustment of the suction system. When the preliminaries are over, Group-Captain Cuming will try some brief airborne "hops" at 50 miles an hour or over.

Finally, will come flights with the glider towed behind an aircraft. While the pilot is concentrating on the job of flying the glider and getting to know the flight characteristics of the new style of wing, instruments will be recording the various aerodynamic factors, including the drag of the glider on the tow-rope. The results will be compared with recorded data already in existence covering the same glider with its original, standard-type wing.

NEW FIELD

The importance of the suction wing lies in the fact that it may open up a completely new field for the aeronautical designer and engineer. At this stage the research men are hesitant about forecasting its

future importance. So much remains to be done, they emphasise. It's much too early; the suction wing is still in its early stages, they point out. It would be unwise to make extravagant claims, in view of the fact that it has not yet been proved in flight.

But behind the natural caution and reticence of the scientist there is a feeling of confidence that the suction wing holds big possibilities for the future of aviation.

The conventional aerofoil that has been developed down the years is more or less cigar-shaped in section, with a somewhat blunt leading edge and a finely-tapered trailing edge. There are more than 1000 variations within these limits, and the particular outline chosen for the wing of any aircraft depends upon whether the paramount need is for greater lift or greater speed. Broadly speaking, wings are divided into high-lift wings and high-speed wings, and a compromise has to be reached between the two shapes in the case of most planes.

In seeking faster flight and safer flying, designers have been experimenting with wings of many shapes, but mainly leading to thinner wings in the case of high-speed aircraft. This trend is evident in the many sleek planes that have been appearing on the world stage during the past two or three years—planes that have reached, and even passed, the trans-sonic speed range.

HIGH SPEED EFFECTS

At very high speeds, the smooth flow of air over the wing is interrupted. At some point along the curve of the wing's surface the laminar flow breaks away, creating turbulence that builds up into greater resistance. This air-drag is reflected in wasted engine power.

An English aerodynamicist, Dr. A. G. Griffith, advanced a theory that laminar flow over a wing of thick section might be maintained by "scooping out" part of the upper section and introducing suction slots at the point where the laminar flow of passing air would normally break away. By sucking the air into the wing the braking effect would be overcome, while the air could become a jet that would provide additional propulsive power, Dr. Griffith believed.

Research work has been directed to investigation of this theory because greater thickness in the wing of an aircraft offers a number of advantages. From the structural point of view, it is a simpler proposition, and the at same time provides considerable storage space and makes possible the housing of power plants in the wing.

LOCAL VELOCITIES

For aircraft in the higher speed ranges, conventional-type wings meet serious barriers. While it is true that airflow at speeds below 500 miles an hour is relatively consistent, local velocities over highly-contoured wing surfaces are very much higher and may reach the sonic barrier, resulting in compressibility effects. With a normal wing travelling at 700 miles an hour, there will be local velocities as high at 1000 miles an hour—well above the speed of sound.

To reduce adverse effects, greater effort has been made by aircraft designers generally to keep local velocities as low as possible, and this has necessitated decreasing both thickness and the camber of conventional-type wings. Where wing sections of a thickness of 18 per cent of the centre chord were widely used a few years ago, many high-speed planes now have wing of under 10 per cent, and some designs under consideration take the percentage as low as four. This

NORMAL AEROFOIL AT HIGH SPEED

Cross-section of normal wing.

BOUNDARY LAYER SUCTION WING (THE "TADPOLE WING")

Cross-section of tadpole wing.

trend imposes many new structural and aerodynamic problems.

On the other hand, the suction wing would represent a move in the opposite direction. The experimental glider wing now awaiting flight test is 2ft. 6in. thick, which represents 31 per cent of the width of the centre chord of the wing. On an aircraft of 100ft. span, this might mean a wing 6ft. thick.

The suction wing is thus twice as thick as the conventional aircraft wing.

A wing of great thickness would be a marked advantage in an all-wing aircraft—which many aviation experts believe to represent "the shape of things to come."

Already all-wing aircraft are rolling back previous aeronautical conceptions. It seems clear that there are many advantages in the clean all-wing design, in which all surfaces contribute to flight. An example is the US Air Force's new jet-propelled Northrop YB-49 Flying Wing, which is designed for top speeds in the 500-miles-an-hour range. Its deep-section wing of conventional section provides accommodation for the crew and stowage space for fuel and load. There are no protuberances, with the power units placed well within the wing to keep them out of the airstream.

Designers claim that the boomerang shape of the all-wing aircraft means that loss of lift and control occurring with the approach of the sonic shock wave are delayed to higher speeds because the aircraft conforms to the shape of the shock wave. Flight tests of the Northrop YB-49 have shown that the elimination of drag generated in a conventional aircraft by fuselage, tail and protruding engine nacells steps up flight efficiency by 25 per cent in the Flying Wing.

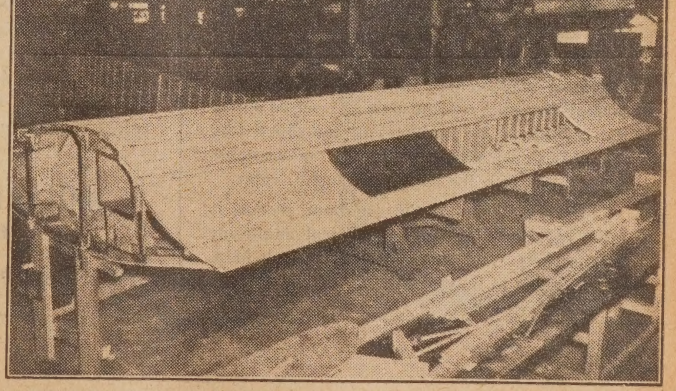
BENEFITS OF DESIGN

Results so far achieved with all-wing aircraft have gone a long way towards substantiating predictions that this type of layout would result in greater speed, longer range and greater load-carrying ability — in other words, in greater all-round efficiency.

When the benefits of the suction-wing are added, who can set the limits of the advance?

Those who like to look far beyond

(Continued on Page 11)



In the D.A.P. factory at Fisherman's Bend, Melbourne, the wing takes shape. This rear view of the centre section shows the removeable traling edge doors.

VALVES AND THEIR APPLICATIONS

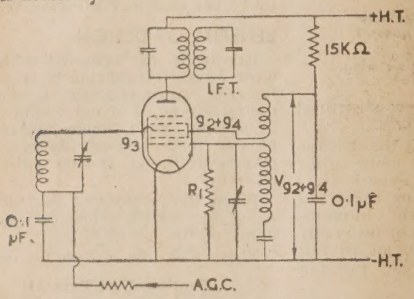
By M. G. SCROGGIE, B.Sc., M.I.E.E. (Eng.)

No. 3: MULLARD HEPTODE FREQUENCY CHANGER 1R5

THIS is a miniature all-glass single-ended heptode with a filament consumption one twelfth that of a pen-torch bulb. An obvious role for it is in portable receivers, especially of the "personal" calibre.

In this country the triode-hexode is so popular that not everbody may be sure about how to use the heptode, or pentagrid, particularly as there are several different kinds. So here are a few notes on the 1R5.

The prescribed range of H.T. voltage is 45 to 90, but g_2+g_4 (used as the oscillator anode) must be limited to 67½, by a dropping resistor if necessary.



This skeleton circuit diagram is merely to show how the valve should be connected; the details of tuning arrangements can follow conventional lines. An alternative scheme, for making the whole mutual conductance of the valve effective in the oscillator, is to take the +H.T. lead from the I.F. transformer via the oscillator reaction coil instead of direct. Any voltage-dropping resistor must be inserted on the g_2+g_4 side of the reaction coil and shunted by the by-pass capacitor. It is then not available for sharing with the screen of the I.F. valve.

Normally, however, the oscillator section is quite capable of providing sufficient amplitude without help from the I.F. anode. Such help, too, is liable to be varied by A.G.C. bias on g_3.

The amplitude of oscillation is not at all critical, and there is little to be gained by striving earnestly to keep it at optimum all the time; it is generally more important to economise in H.T. current. The amplitude is measured by a micro-ammeter in series with R_1. Although 200μA is recommended, the effective optimum, with $Vg_2+g_4=45$ or so, is nearer 100μA, and there is not much loss of signal even at 50μA. Fortunately the optimum increases with Vg_2+g_4. The less oscillator voltage on g_2+g_4 the better; the reaction coil should be comparatively small.

A.G.C. may be applied to the 1R5; the grid base is roughly one fifth of Vg_2+g_4. It is important that the g_3-to-cathode impedance at oscillator frequency should be low, otherwise the action of g_3 may be upset by oscillator voltage from g_2+g_4. It is true that it can be neutralized out by a few pF from g_1 to g_3, but there is no need for this complication if the previous condition is fulfilled.

Mullard

This is the third of a series written by M. G. Scroggie, B.Sc., M.I.E.E., the well-known English Consulting Radio Engineer. Reprints for schools and technical colleges may be obtained free of charge from the address below. Technical Data Sheets on the 1R5 and other valves are also available.

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(M.V.M. 61)

Technical Review

RESEARCH SHEDS NEW LIGHT ON SOLAR STORMS

J. H. Nelson swings an 8-foot telescope toward the sun for a study of the ever-changing solarspots.

A study of sunspot activities reveals new facts about magnetic storms originating from sunspots. They can now be forecast dependably over short periods to within fifteen minutes of the start of their destructive effects on world radio communications.

FORECASTING with such accuracy becomes possible because of a better understanding of solar disturbances, according to RCA engineers.

Their investigations proved that the size of sunspots is a meaningless criterion in predicting havoc that may be caused to radio circuits. Composition of the spots, their polarity and their position on the face of the sun were declared to be the determining factors of lethal bombardment.

Moreover, the RCA investigations established the existence of a "critical zone" on the face of the sun—an area about 26 degrees in radius from the optical centre of the sun, on its eastern hemisphere. It was discovered that the position of sunspots in relation to this critical zone was of utmost importance. Damaging effects on world radio communications occur when they are within this zone.

"The existence of a critical zone on the sun," the RCA engineers said, "poses an interesting speculation with regard to the existence of a solar ionosphere, or the equivalent thereof, corresponding to the layer of ionized gas surrounding the earth. This might be the corona or the prominences overlying sunspots.

If the 26 degrees semi-circle delineates a region from which radiations affecting the earth's ionosphere are confined, these radiations penetrate the solar ionosphere, only when about seven minutes of arc of the line connecting the sun and the earth. Sunspot radiations of lower angle do not reach the earth, or are returned to the sun."

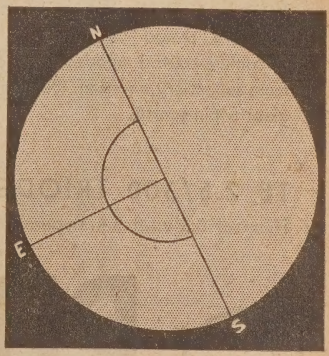
"We have established that mere size of a sunspot is a meaningless criterion in assessing its possible damage to communications, the report stated. "A huge spot, consisting mostly of penumbra, or dark fringe, may be a complete dud in its effect upon radio circuits. A small spot mostly umbra, or inner darkness, may be quite deadly. Rapidly changing spots, indicative of activity, are the most lethal in their effects upon radio circuits.

The RCA scientists accredited the Mount Wilson Observatory with providing regular reports on the polarity of the umbras as red (positive) and violet (negative), together with relative intensities of the red and violet. It was found that the reds have a preponderant effect in the northern hemisphere of the world, violet in the southern hemisphere. Reds were said to depress frequencies in the northern hemisphere and raise them in the southern. The action of the violet was discovered to be vice versa.

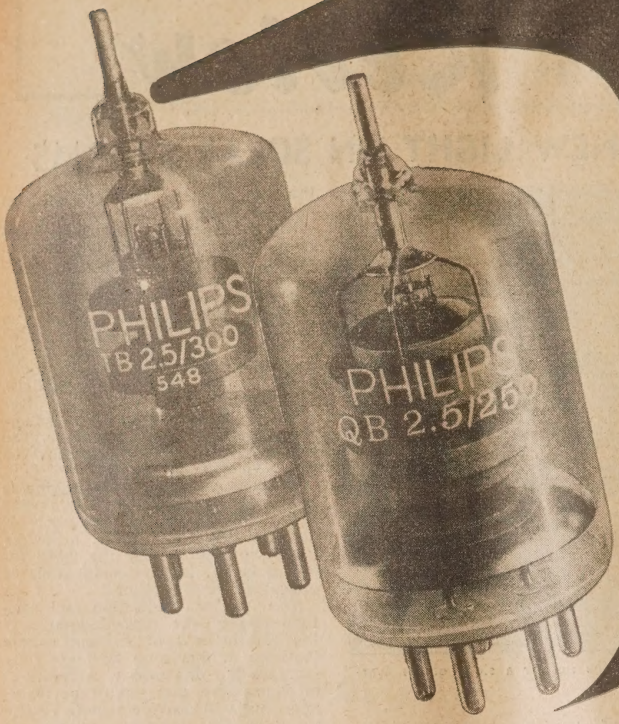
"This phenomenon," the engineers said, "may be due to the earth's polar attraction for solar radiations of opposite polarity, causing a lowering of ionisation near the poles for one polarity, and intensification of ionisation for the other."

The further localisation and confirmation of the critical zone, and the confinement of sunspot counts to those in this zone, will not only increase the day-to-day correlations of ionosphere and circuit performance, but will provide a more realistic basis for frequency predictions over the sunspot cycle.

"Practical application of the critical zone, as here indicated, has produced a dependable forecasting service with many hits registered within fifteen minutes. Its use is now an accepted RCA service.



The semi-circle on the left of the upward line indicates the "critical zone" of the sun where the presence of sun-spots most seriously affects radio communications.



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Only five inches long and 2½ inches in diameter, these new Philips valves have a power output of more than 200 watts at 100 Mc/s. or 300 watts at lower frequencies. These valves embody entirely new techniques and offer unequalled efficiency. Their construction minimises internal insulation. Base pins are sealed by fusion of powdered glass. Zirconium-coated anode gives complete freedom from secondary emission. Base pins fit the standard giant 5 pin socket.

TB 2.5/300 TRIODE

Filament 6.3 v. at 5.4 amperes.
Anode volts 2,500 maximum.
Anode dissipation 135 watts.
Cathode current 240 mA.
For use as amplifier, oscillator or grounded grid amplifier, at VHF and HF's.

QB 2.5/250 TETRODE

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Anode volts 3,000 maximum.
Anode dissipation 125 watts.
Cathode current 240 mA.
Screen grid volts 500 maximum.
Screen grid dissipation 25 watts maximum.
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V13A—48

MOVIE TECHNIQUE CANS TELEVISION PROGRAMMES

Through the use of a new NBC development called the Television Recorder, television programmes including picture and sound can now be recorded on film direct from the screen of a television receiver. The film can be distributed to stations not interconnected by coaxial cables and radio relays.

AS the quality of the basic television image improves, the quality of recordings in kinescope photography will be enhanced to a degree where the average viewer will be unable to tell if the programme he is seeing is "alive" or "canned." The kinescope recorder method will also allow retention of television programmes.

The development of this recording system was started in 1938 with experimental cameras operating at 8, 15, and 16 frames per second. They were followed by a prototype camera operating at 24 frames per second. This model was the forerunner of the 10,000-dollar recorder cameras in use today.

NOT ENOUGH LIGHT

In the earliest experiments, it was found that the amount of light obtainable from available kinescopes was not enough to produce a full exposure on the fastest films obtainable at 1-30th of a second exposure in a 16-frame-per-second camera.

The cameras used in the early efforts were spring-motor driven and the shutter rate was not synchronous with the frame rate of the television system. This caused a flaw in the pictures called "shutter bar" or "banding," in which a black and white bar moved across the film image when projected.

Much research work in finding an accurate method of operating the motor-driven shutter in conjunction with the sequence of television images finally led to an acceptable mechanism free from banding effects.

DIFFICULT PROBLEMS

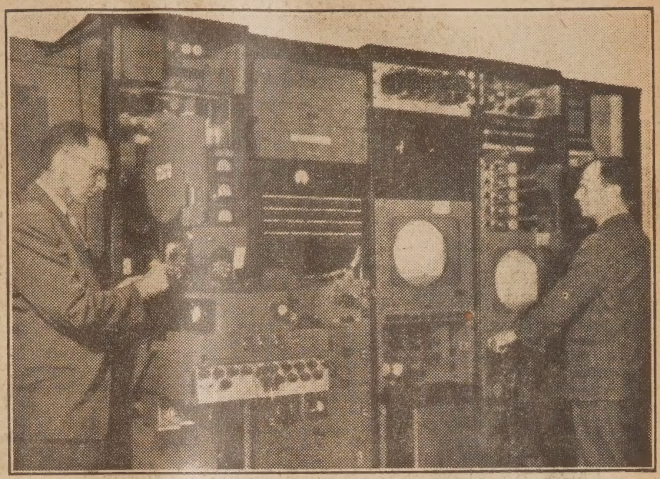
Engineers of the Eastman Kodak Company and NBC designed a commercial camera along the lines of the original model. However, the design of the new camera was complicated by many factors.

First, the commercial version had to be able to record a half-hour show with a 1200ft. load of 16mm film, instead of the 200ft. roll used in the first model and in regular Cine Specials.

The shutter had to rotate with a minimum of flutter, since even a slight change in angular speed resulted in banding of the film image.

Success eventually came through the use of a synchronous motor to drive the shutter at the necessary speed through a set of precision gears. Another synchronous motor of larger capacity drives the film transport mechanism and the Geneva intermittent, which is the device that pulls down the film strip from one frame to the next.

The two motors are kept in step during the starting and stopping periods by an ingenious coupling which allows the stronger of the two motors to assist the weaker until both reach proper speed. The coupling then floats so that there is no physical connection between the motors.



Complete television recording equipment including camera at extreme left with sound recording and monitoring panels.

Nylon, which has a low coefficient of friction, is used in the film gate and pressure plate to minimise the accumulation of emulsion from the film. All friction points in the take-up side of the 1200ft. magazine are equipped with ball-bearings so that take-up of film progresses smoothly from the two-inch core diameter of the empty reel to the 10in. diameter of the full 1200ft. roll.

Focusing and framing of the picture are carried out by means of a right-angle view-finder equipped with a magnifying lens. Visual focusing is done by means of this finder and checked by exposing film at several different settings. Before each programme is recorded, processed film is examined under a microscope to determine the best actual focus.

The camera lens is a two-inch Eastman anastigmat F1.6. Normally, apertures of F2.0 to F2.8 are used.

For several reasons, 16mm film, rather than 35mm film, was selected for kinescope recordings. One of the main reasons was that the cost of 35mm film is somewhat more than three times the

Continued on Page 35

Ralph Lovell examines the mechanism which applies the sound recording to the edge of the film containing the television recording.

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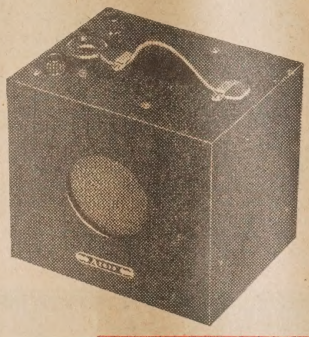

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Weighs only 4¾lbs., yet the Aegis PP4 is a powerful 4-valve battery operated portable only 4in. x 4¾in. x 9in. Features include lightweight leatherette covered case in choice of colours with pencil-case slide back for easy battery change, self-contained loop aerial, midget 2-Gang by A.W.A., Radiotron Valves, 3in. Rola Speaker, Ducon Condensers, Minimax Batteries, etc. Price, complete with valves and batteries, is only **£16/17/6**

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GERMANIUM CRYSTAL MAY REPLACE VALVES

Considerable interest has been created by references in recent months to a device which may render radio valves obsolete, at least in respect to many of their present-day applications. Lates' 'nformation on the subject reveals that the "transistor" is a development from the wartime germanium diode.

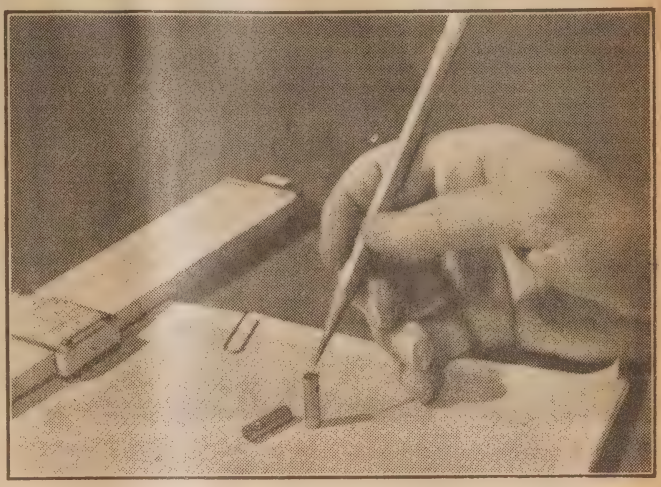
DISCUSSING the new development, an American technical writer says:

"The glass vacuum tube in your radio has its first rival in 40 years —a bit of semi-conducting germanium metal that amplifies or oscillates current without the complexity of plates and wires in an airless bulb.

"This new transistor, as it has been christened, should allow more stable and durable radios, television sets and electronic devices. Radios may be made smaller, when the new cylinder, slimmer than a pencil and less than an inch long, comes out of the development laboratories into production."

Because the new device has no filament that must heat up before it operates, it goes into action instantly. It will do some electronic tricks that conventional vacuum tubes can't do. This means new electronic devices.

Invented at Bell Telephone Laboratories in New York, the transistor's operation is possible because the ability of a semi-conductor to carry electrical current can be controlled. This is done by changing the electronic structure of a small bit of material under the influence of the incoming current, fed to it through a fine "Cat's whisker" wire. The current coming out of the other wire, just about two thousandths of an inch away, is boosted in volume a hundred fold.



This picture gives some idea of the diminutive size of the new "Transistor." It is much smaller than conventional miniature valves and can be used at least up to television frequencies.

Dr. John Bardeen and Dr. Walter H. Brattain made the key investigations in the Bell Telephone Laboratories that produced the transistor, while the programme was initiated and directed by Dr. William Shockley.

Since electrical speech waves travelling between telephones can be amplified, the transistor will probably replace the vacuum repeater tubes now used on long distance and other telephone lines.

A superheterodyne radio set with about a dozen transistors instead of conventional tubes has been demonstrated and probably is the forerunner of a new family of radios.

Because it can oscillate as well as amplify, the transistor will be used to produce standard frequency tones and for other similar uses.

Germanium metal specially treated is the semi-conducting material used, but other semi-conductors include silicon, some metallic oxides and other compounds. Semi-conductors have electrical properties intermediate between those of the metals and insulators.

Semi-conductors, copper oxide and selenium have been used previously to rectify alternating to direct current, and silicon has been used as a detector, particularly for microwave radio apparatus.

The transistor as now developed was reputed to have a frequency limitation of about 10,000,000 cycles per second, but it promises to be quite satisfactory in the television ranges.

"TADPOLE WING"

(Continued from Page 5)

immediate developments forsee great possibilities in the application of the boundary layer suction principle to aircraft in the all-wing style.

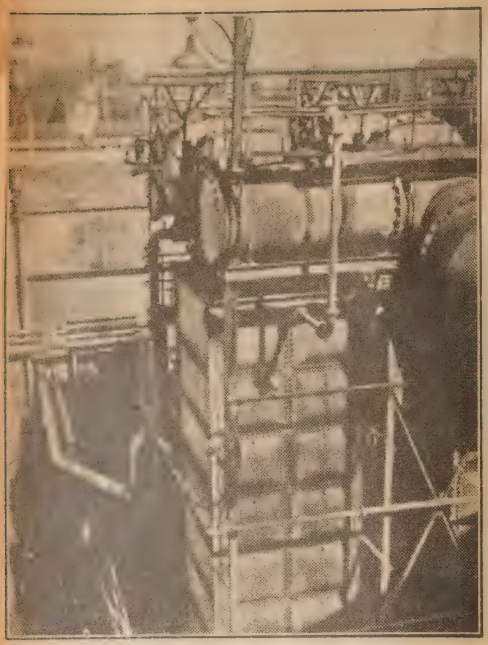
But those who have been carrying out the experimental work on the wing cannot be drawn into any unqualified predictions. The scientist tackles the problems as they emerge, concentrating on detailed investigation of each successive phase and taking things one step at a time. Work so far has been confined to the testing of the first part of Dr. Griffith's theory—that the laminar flow of air around a thick wing might be maintained by a series of suction slots in its upper surface just below the "scooped-out" section.

Various aerodynamic features of the boundary layer suction principle have been determined by extensive wind tunnel exploration. The glider wing provides for the air sucked in at the slots to be ejected from the sides of the glider in such a way that it should not interfere with its flight characteristics. Only when the fundamental principle has been established in this full-scale test and details checked will any effort be made to incorporate Dr. Griffith's idea of a propulsive jet.

Those most closely associated with the work believe it is too early to give any definite assessment of the potentialities of the suction wing. While it is true that wind tunnel tests have given encouraging results there are still many hurdles before the project can be classed as an unqualified success. Full-scale tests may not substantiate present indications, and it may be necessary to start again.

But if the theory is proved sound the boundary layer suction wing may well prove to have opened new horizons, giving Australia and the British Commonwealth a flying start in an important new phase in aeronautical development.

Ancient Lights is a privilege, now regulated by British law, whereby the light entering an existing window may not be interfered with. The old interpretation that windows enjoying ancient lights must have existed from earliest days in England is now legalised as "a period of 20 years."



The condensers, in which tar and water vapours in crude gas are reduced to liquid form and run off into wells.

Red-hot coke being quenched with water in a container, steam being given off and later extracted.

HOW COAL GAS IS MADE

Although electricity has replaced gas in many applications, there are still numerous industrial and domestic uses for which coal gas is essential. This article tells you how it is made, and some of the valuable by-products of the process, some of which have been the basis of new development and techniques in science and industry.

UNTIL we are deprived of something we have used for a long period we do not realise its value, or stop to think of just what goes into its manufacture.

This is the case, I venture to say, with that substance called coal gas, around which much controversy rages today.

Most people are familiar with those big gas holders which they pass on their way to work every day. Also very familiar are the variety of smells which emanate from the gasworks.

USES FOR GAS

I conducted an unofficial survey among friends and acquaintances recently. The result showed a surprising lack of knowledge of the actual uses for coal gas. Everyone knew it came from coal, but few knew how it was made or what by-products came from its manufacture.

Industry today depends on coal gas in many ways. It is used for melting type in the printing industry, for casting metals, for heating moulds in the plastic industry, for muffle furnaces in chemical works. The canning industry uses it. Hospitals require it. In fact, there is scarcely an industry which does not use gas in one way or another.

It is superior to electricity for certain specific purposes and can be used where electricity cannot, such as in blast furnaces. This does not mean it is better in all ways than electricity. Both have their advantages, but as this is an article about coal gas the uses of electricity need not be discussed. (I hope I have now made myself right with the manufacturers of both commodities.)

I first want to touch on the manufacture of coal gas and then say something about its by-products. The latter are many, and can only be dealt with rather briefly.

When coal is heated it is broken up into simpler substances, some of which are gaseous and others solid.

This fact was known for many years prior to 1800, but was not put to use until that year, when William Murdoch first lighted a factory in Birmingham by means of coal gas.

The heating compartments for the coal are called retorts. These are some 20ft. long and perhaps 7ft. wide, lined with silica clay.

Retorts can be horizontal or vertical. Both are used in different works. The horizontal retorts are usually "D" shaped, with the flat side of the "D" as the floor of the retort.

VERTICAL RETORTS

Vertical retorts are of fireclay. They may be 25ft. in height and of elliptical or rectangular section. The widest measurement is usually about 7ft., but the minor axis tapers from about 18in. at the bottom to about 8in. at the top. Thus a cross section of a vertical rectangular retort would be wedge-shaped. The reason for this lies in the fact that when coal is heated and turns into coke it expands and therefore requires more room.

There are advantages which the horizontal retort and the vertical retort have over each other but which

need not be discussed here, as the final result is gas and by-products, which is our main theme.

Retorts are usually built in "settings" containing a number of them, usually about ten. The "setting" may contain two vertical columns of five retorts. One retort house may contain about 500 retorts for a large works.

At each end of the retort is an iron door lined with fireclay and a pipe for taking off the gas.

The retorts are loaded with the charge by mechanical loaders, consisting of a receptacle which holds just enough coal for one charge. This is injected into the retort by means of a ram, which first pushes the spent charge out of the retort and then pushes the fresh charge in.

It is interesting to note that the coke from the retort is used to heat the retorts. The red hot coke, as it is pushed from the retort, falls through an iron doorway in front of the "setting." If more coke than is wanted for heating is pushed from the retort the surplus falls into a rapidly-moving stream of water, which conveys it away.

THE PRODUCER

The heating compartment is called a "producer" and the heating of the coke depends on a rather technical process which makes use of steam for the production of water gas, a mixture of hydrogen and carbon monoxide.

It is usual to have a residue of about 12 hundredweight of coke from every ton of coal burnt in the retort.

Retorts must be periodically put out of commission owing to the large amount of carbon which is deposited on the walls. This carbon is a very hard and compact form of a type used in the manufacture of arc lamp carbons and electrodes.

Carbon is usually burnt out of the retort by forcing air through the red hot retort while it is open at both ends.

The gas as it comes from the retort is very impure and must be cleansed. In the case of horizontal retorts the gas, by means of slight suction supplied by exhausters, is drawn through water in what is called a "hydraulic main" and led into the condensers. This hydraulic main helps to condense some of the products of the retort and also prevents the entry of air into the gas when one of the retorts is left open for burning off of carbon, for all the retorts are connected to the hydraulic main. Vertical retorts do not require a hydraulic main, as they are more or less always closed, the coal being fed through the top and working through the retort by gravity.

CONDENSERS

The gas is now taken through the condensers, which are similar to the condenser pipes seen in ice plants—a zig-zag row of pipes cooled by water or, in some cases, merely air cooled.

The condensers rid the gas of the substances which are liquid at normal

by Calvin Walters

temperature, and these are led from the bottom of the condensers to buried tar wells. A fair amount of water also condenses from the gas, and this water contains ammonia.

In order to remove remaining particles of tar which may be in the gas in the form of fog, the gas is washed by a violent agitation in water in a "washer."

In the washer the gas is passed in fine jets through water, which dissolves ammonia and other soluble impurities.

Next comes the scrubbing operation. One method of scrubbing is to allow the gas to ascend a high column packed with coke through which water trickles. The more usual method is by means of a cylinder in which is a paddle-wheel arrangement. The cylinder contains the liquid and the gas is passed through the cylinder while the paddles swirl the liquid up into a fine spray. This forms a liquid screen through which the gas must pass, thus dissolving out the remaining ammonia.

PURIFYING

One of the most objectionable impurities of coal gas is sulphuretted hydrogen, that gas which has a smell of "rotten eggs." No trace of this must be left in the gas, and it is removed in the purifiers, which consist of layers of iron oxide. This oxide has an affinity for sulphuretted hydrogen which is readily absorbed. The iron oxide is recovered again and again by a process which removes the sulphuretted hydrogen, and so little is wasted.

From the purifiers the gas is passed through a fine spray of oil, which dissolves out the naphthalene, and the gas is now ready to pass to the gas holders.

Gas holders are of three main kinds. The water type, the waterless type and the spherical.

The water type seems to be the most popular in this country. It consists of a deep well of water over which is inverted a huge steel cylinder, counterbalanced so that the gas at a fairly low pressure, is able to lift it. In fact, the cylinder is slightly heavier in order to force the gas out again into the mains when the supply of gas entering the cylinder is turned off. Lifting of the cylinder is also assisted by the fact that coal gas is lighter than air.

The waterless type of holder is a huge cylindrical container above ground with a telescopic roof which slides up and down in the cylinder. The roof is the means of forcing the gas out of the holder when the supply is turned off.

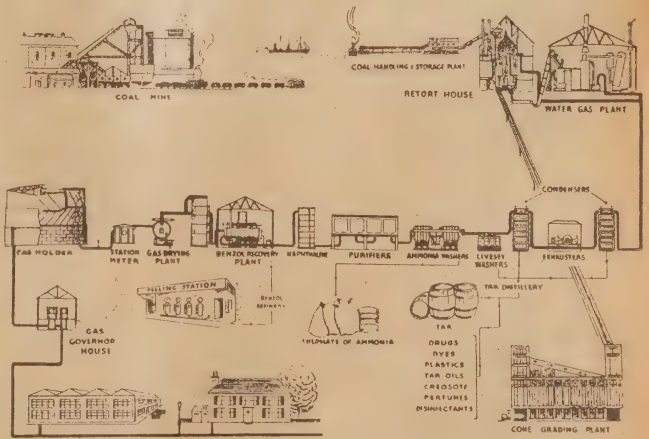
SPHERICAL HOLDERS

The spherical type of holder is used for storing gas under pressure. Gas is usually pumped into the sphere at a pressure of 50 pounds per square inch, which is equivalent to about three atmospheres. Thus, when a tap connected to this supply is turned on, the gas will expand to a volume three times greater than it occupied inside the holder. From a spherical gas holder of 3000 cubic feet capacity it is thus possible to obtain more than 9000 cubic feet of gas.

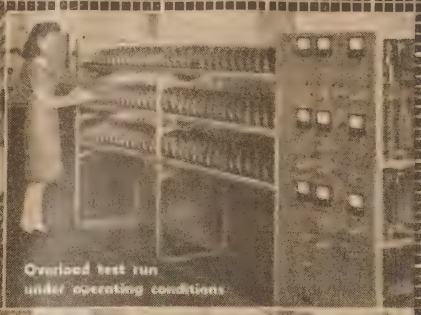
Having described the method of gas manufacture, we will now consider briefly the wealth to be obtained from coal tar.

Coal tar is one of the most wonder-

(Continued on Page 33)



A plan circuit of the processes which take coal from the mines, extract valuable by-products, and deliver clean gas to the private home.



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POPULAR SCIENCE DIARY

By PROFESSOR A. M. LOW, ENGLISH WRITER, SCIENTIST

BATS ARE NOT BATTY

NOW about bats. I mean the winged mammal which startles everyone by flying round the belfry. For many years it has been known that the squeak of a bat was very quick. In short, it is pitched so high that only youthful ears can respond. But more wonderful is it that, ig bats are allowed to fly free in a pitch dark room across which innumerable wires have been stretched, they will fly in and out of the wires without touching them at all. Is it that they see by infra-red light reflected from the bats? It is not. Careful tests with instruments far more delicate to higher pitches than our ears have

found that the bat emits short bursts of squeaks with a frequency of about 50,000 per second. These supersonic sounds bounce off the wires, are picked up by the bats' hearing apparatus, and the creature flies in safety exactly as if it was using radar with sound substituted for ether waves. The whole subject of these ultra-high-pitched sounds or supersonics is interesting, for they have been known to kill fish, and to metamorphise certain types of bacteria. It is not likely that they will be used one day as a death day, for, although sound has great power and can do great harm by battering our bodies, I think it more probable that the Walls of Jericho were pure allegory.

IF ONLY IT WORKED

ONE of my ambitions is to have a cigarette lighter which invariably works. Especially when I think of all the ways there are of obtaining light and of the old days when one person in the village kept a fire and sold lights to the unfortunate inhabitants.

One can rub sticks together, although it is extraordinarily hard work when tired. One can compress air suddenly in a bamboo cylinder and savages do this, too. We can make phosphoretted hydrogen which ignites in contact with air, and even this has been used to obtain automatically lit acetylene.

But the common or garden flint shows by its name how popular was the tinder-box of our great-grandfathers. These little pieces of pyroforic metal are, of course, not flint at all, but are made of a mixture of bismuth, antimony and other friable metals. The steel wheel scrapes off particles so small that they ignite under the heat of cutting. Steel wool will burn furiously if given the chance. (I will now borrow a match!) Which reminds me that there were once cigarettes containing a lighting end, which one rubbed upon the trousers or a convenient piece of furniture. Disadvantage—tobacco suffered in flavor.

I am so glad I wrote this, for an amazing thing has happened. I have discovered the Camlighter, which not only works, but always works. I call it the "inclined plane" machine, for it is roller operated, no queer springs, no cogwheels. Nothing except a grand light; very clever.

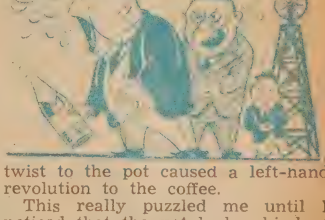
IT KNOWS WHICH WAY

I HOPE you will think none the worse of me for being able to make my own coffee in a very common saucepan. Incidentally, I believe most of these infusions are wrongly made, and that there should be a slight vacuum to extract the essential oils which give the flavor. Just as in pressure cooking, one prevents water boiling by allowing the pressure to increase.

You will realise that the pressure under which a liquid stands normally decides the temperature at which it would have boiled. It is not easy to cook potatoes adequately at the top of a very high mountain, while at the bottom of a mine the temperature might be considerably above 100 degrees C., and vegetables could be overheated without difficulty.

There is a true story about some directors of a mine who celebrated a certain occasion with champagne at the bottom of the mine shaft. Under this pressure the wine was rather flat, but when they came to the surface it gassed violently upon release of pressure, and the poor directors were quite unable to declare a dividend for a long time.

Now, in my coffee saucepan I observed an amazing phenomenon. Fill it with enough for one cup and twirl the saucepan in a clockwise direction, when the coffee follows suit and also twirls right-handedly. But putting enough milk and water for three people and giving a right-hand



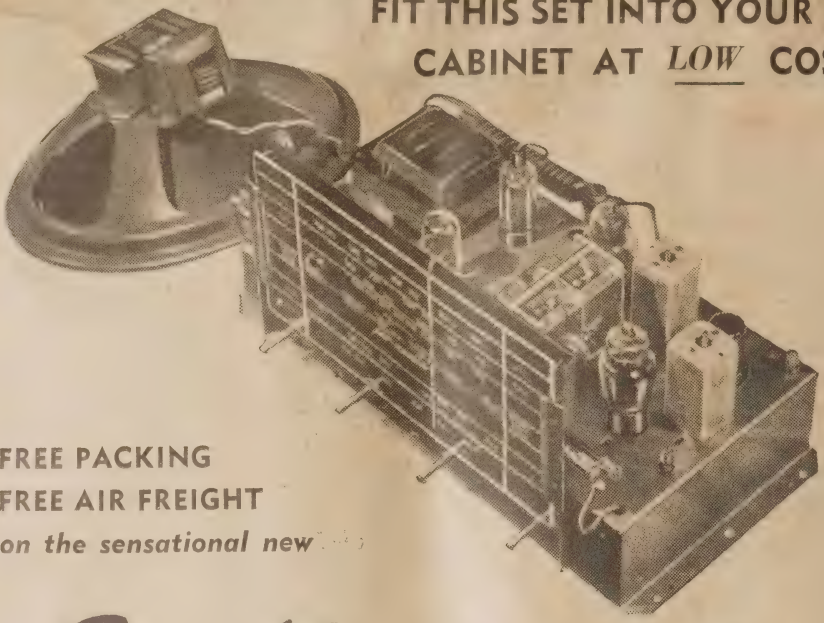
twist to the pot caused a left-hand revolution to the coffee.

This really puzzled me until I noticed that the pot had a kind of ledge, which was not overclean. Of course, these ledges caused a vortex action and being smoother on one side than the other, the result was a "gear wheel" driving the coffee backwards.

BRITISH JET-ENGINED MODEL

Jet engines for models are the coming thing in Britain. This aircraft is powered by a "Juggernaut" engine designed by E. A. Jaggers. It reached 144.8 mph recently at Southport, England, and is an improvement on the German "Buzz Bomb" unit.

FIT THIS SET INTO YOUR OWN CABINET AT *LOW* COST



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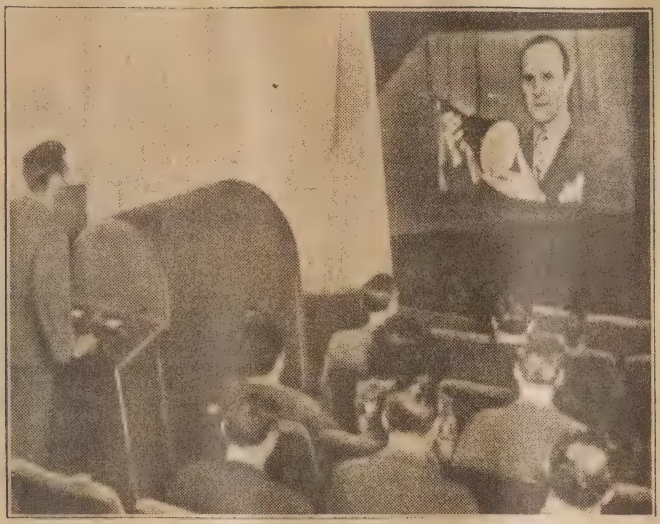


Demonstration of large screen television projection, providing a screen picture 6 by 8 feet.

Huge screen television developments are likely to create major changes in theatre programming and film production, according to W. W. Watts, RCA Engineering Products vice-president. In this article, he outlines some of the main factors looming ahead.

THERE are, of course, other forms of television than the home type. One is Large-Screen Television, a nomenclature applied to television pictures varying from 6 by 8 feet to 15 by 20 feet.

Although usage has invariably linked these projection systems to the "theatre," it is my belief that theatre television is but one of many applications for large-screen television equipment. As one example, it is conceivable that such equipment will be used for audiences at television studios since the presence of large numbers of visitors to studio sets when in use is fully as impractical in television as in motion picture studios.

Promotional use of large screen television in connection with sports and news events also will be made and may, in some cases, displace the "moving light" bulletin boards now widely used by newspapers. Overflow auditoriums, department stores, hospitals, hotels, cocktail lounges, and night clubs provide additional fields of usage.

And speaking of things to come, there is an additional RCA television item which is due on the market shortly in limited quantities. This is a large-screen, nominally priced television projector capable of a 7-by 9-foot picture, suitable for theatre lobbies and lounges.

Much of the equipment which has been mentioned here utilises motion pictures. It has been estimated that television stations of this country ultimately will require many more feet of film than Hollywood now produces, a condition aided and abetted by the fact that there are few chances of "extended runs" on television.

Everyone knows that television broadcast stations use and require vast amounts of film fare for programming. They are obtaining some of it from a supply "made in Hollywood." Of its quality, all one can say is that it is the best Hollywood made in those years. Why, one might ask, does the public accept the current film fare? The answer is simple: novelty and lack of competition. As viewers and sponsors increase, they will demand and get better film programming. Furthermore, it is our opinion that advertisers will finance much of this film programming, because we are convinced that the American pattern of free television, like free radio, already has been established and will continue.

The term "film storage and kinescope photography systems" refers to the business of filming the picture from a special high-intensity television monitor. Adoption of this method makes the television broadcaster a producer of pictures —perhaps chiefly for syndicate or transcription purposes, but nevertheless a producer of pictures.

If you could build a theatre large enough to accommodate at one time all of the patrons who attend a three-week run, you would show your film only once. That, in effect, corresponds to television.

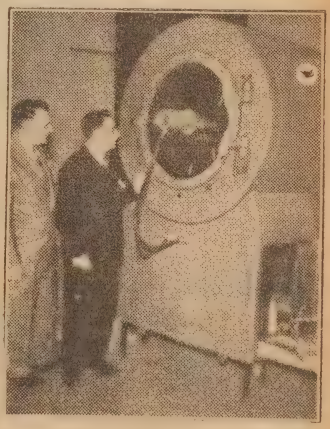
TELECASTER IS A FILM PRODUCER

A little forecasting based on current AM-FM broadcast practice provides some idea of what the potential film usage of television might become. Today there are about 2500 AM-FM stations on the air. Nearly half of these are affiliates of the four major chains. They operate about 18 hours per day. Conservatively, they use five hours of chain-originated material daily. That adds up to 4 chains times 5 hours (20 hours daily), times 365 days, or 7300 hours of network-originated material per year.

Now let us see how these figures might apply to television. It has already been pointed out that the FCC has prepared nearly 1000 channel allocations in 456 cities. Let us assume that when these 1000 stations are on the air, they follow the current broadcast pattern, carrying chain material for the same 5 hours, with 2½ hours programmed from film. Four networks times 2½ hours (10 hours per day) times 365 days, means 3650 hours of film annually.

That is the equivalent of 1825 two-hour features, or 14,600 15-minute shorts—plus all the additional film material the 500 remaining independents will use, which is not network originated.

It will require far more film, more technicians, more talent, and more equipment than exists today. It presents an opportunity to which both the motion picture industry and the television industry can anticipate with high enthusiasm.



A television projector giving a 15 by 20-foot screen image.

RADIO CABINETS

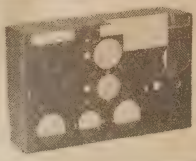
R.B. CONSOLE — Choice of Light Oak or Walnut finish.
£8/15/4

SMALL MANTEL — Walnut finish, Size 10½in x 6½in x 6½in.; suitable for Kingsley KFT3 Ferro. Kit.
£2/1/3

HAMS & HOBBYISTS!!

these and many more
Spring Snaps at . . .

VEALLS



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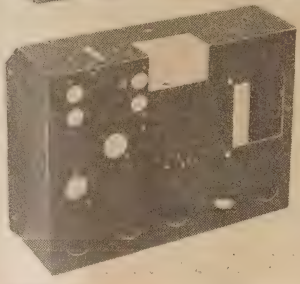


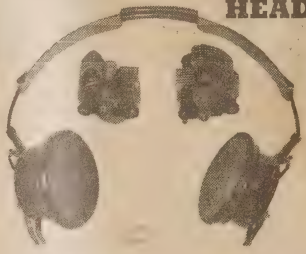
Xmas Portable 7/11
Handle Talkie 3/8
Little General 7/11
1947 Advance 5-valve .. 10/11
1946 Standard 7-valve .. 11/10
Radiogram 8-valve .. 14/10

Tecnico Low-Pressure Pickups

MODEL FP8—Crystal pick-up with permanent built-in sapphire stylus, and low needle pressure. Uses LP6 Astatic Crystal Cartridge. Frequency range, 50-4500 c.p.s.; Needle pressure, 1oz.; Overall length, 9⅞in. For use with 10in. and 12in. records. PRICE **£6/9/-**

MODEL FL48—This is a replaceable needle pick-up for general use, offering improved performance due to lower needle pressure. 1½oz. and higher needle point compliance. Frequency range, 50-4500 c.p.s. Equipped with type L-40 Astatic Crystal Cartridge. PRICE **£5/4/-**

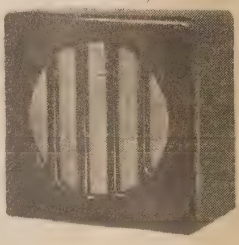
HEADPHONES



Illustrated are BROWN Headphones, 33/9 pr.

Available also are EMMCO, 47/4 pr. (Heavyweight)

LEATHERETTE CABINETS and SPEAKER BOXES



Handle Talkie Portable 30/6
Standard 5-Valve Portable 46/9
6" Speaker Box .. 19/7
8" Speaker Box .. 23/6
10" Speaker Box .. 28/6
12" Speaker Box .. 32/3

MIDGET CONDENSERS

The Midget Condensers illustrated are R.C.S., available in the following types:

C.V. 34	2 Plate .. 4/-	C.V. 42	3 Plate .. 7/9
C.V. 35	3 Plate .. 4/3	C.V. 43	4 Plate .. 8/4
C.V. 36	4 plate .. 4/6	C.V. 44	5 Plate .. 9/-
C.V. 38	7 Plate .. 5/3	C.V. 45	7 Plate .. 9/6
C.V. 40	14 Plate .. 6/6	C.V. 46	9 Plate .. 10/-
C.V. 41	2 Plate .. 7/3	C.V. 47	14 Plate .. 11/3

Obtainable also from our Associate Companies

VEALLS (Swanston St.) Pty., Ltd., 243 Swanston St., Melb. FJ3145
VEALLS PRAHRAN PTY. LTD., 299 Chapel St., Prahran. LA1605

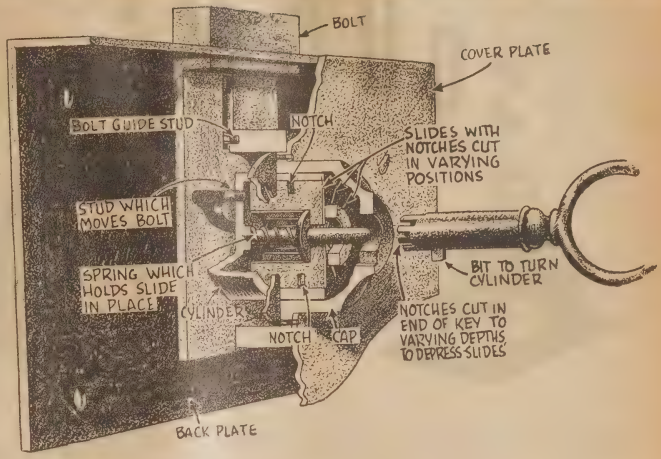
Mail Orders to Box 2135T, G.P.O., Melbourne.

VEALLS
ELECTRICAL & RADIO PTY. LTD.

Head Office: 490 ELIZABETH ST.
MELBOURNE - - - FJ 3145
Telegrams: "VELRADIO"

HOW IT WORKS—THE BRAMAH LOCK

Invented by Joseph Bramah and patented by him in 1788, the Bramah lock has been widely used for desks and cupboards and as a doorlock. Sketched here in diagram form is a lock of this type in use in a till.

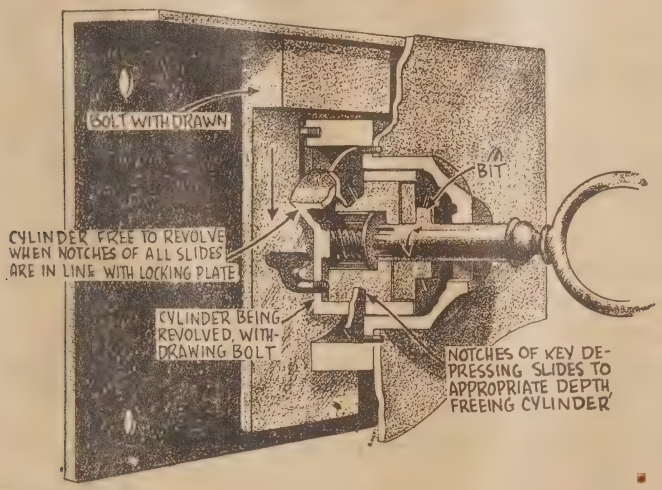


AS can be seen, a small round case or cap is fitted to the front plate. A small hole and notch for the key are in the middle of the cap. Inside is a brass cylinder linked by a stud to the bolt of the lock. The cylinder is held forward by a spring, and normally is prevented from rotating by a series of steel slides placed radially within the cylinder.

These steel slides bear against a fixed locking plate.

At varying depths, a notch is cut in each of the slides, every notch being in a different position.

The key has notches cut in its end, also of different lengths, and when the correct key is inserted in the lock it forces the slides down so as to bring the notches of all the slides on a level with the locking-plate.


BOLT WITHDRAWN
BIT
CYLINDER FREE TO REVOLVE WHEN NOTCHES OF ALL SLIDES ARE IN LINE WITH LOCKING PLATE
CYLINDER BEING REVOLVED, WITHDRAWING BOLT
NOTCHES OF KEY DEPRESSING SLIDES TO APPROPRIATE DEPTH FREEING CYLINDER

KEY WILL TURN

This makes it possible for the key to be turned, and the bit projecting on its shank revolves the cylinder.

As the cylinder turns, it carries with it a stud which in turn moves the bolt.

The possible combinations for different positions of the notches on the slides run into millions, so that the Bramah lock offers security with simplicity. The key, being very small, is easily carried, and the lock itself is very compact.

Sketches show the lock closed (upper view) and the opening of the lock when the key is inserted and turned (lower).

DDT TESTED IN WIND TUNNEL

MOSQUITOES in a wind tunnel are the newest means for testing the effectiveness of DDT in aerosols or fogs, such as are used for the large-scale "depesting" of summer resorts, athletic stadiums and the like.

The work is being done as a joint research project at the Beltsville, Md., experiment station of the US Department of Agriculture, near Washington.

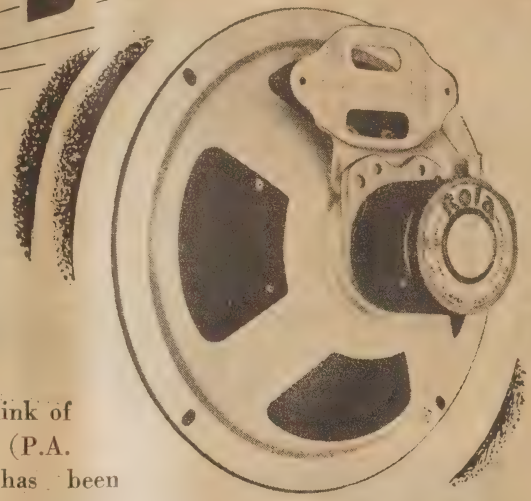
The wind tunnel is small, as compared with those used in aviation research: only a foot square in cross section and 32 feet long. About midway of its length a wire cage containing the victim mosquitoes can be inserted. Air speeds are low, simulating normal out-or-door conditions: they ranged from two to 16 miles an hour in the present experiments.

DDT fog was released by a standard method, to give particles of controlled diameters, from one to 20 microns—that is, from droplets about the size of the smallest known bacteria up to specks just barely visible to the naked eye. Mosquitoes in batches were bombarded with particles of all sizes, at the four velocities used. Results were measured in terms of percentages of dead mosquitoes.

In general, it was found that better kills were obtained with the larger DDT-fog particles, and that higher air velocities were more effective than lower ones. It was even possible to plot the results as ballistic curves. The experiments are still being carried on.

Earliest results, just reported, were obtained in a joint research programme shared by the US Bureau of Entomology and Plant Quarantine and the Central Aerosol Laboratory of Columbia University, supported by OSRD and NDRC funds. Workers were Drs. Randall Latta, Lauren D. Anderson, E. E. Rogers, V. K. LaMer, S. Hochberg, H. Lauterbach and I. Johnson.

SOUND!



WHEN you think of Sound, think of the new Rola Model 8M (P.A. Type) loudspeaker, which has been specially engineered for Sound system designers and users.

Model 8M (P.A. Type) has been designed to provide the utmost of intelligibility—that crisp, clean speech reproduction which is an essential in any Sound system.

To facilitate flexible and economical stockage we supply Model 8M (P.A. Type) without transformer, but provide a range of Type "C" Isocore transformers to match impedances from 500 to 25,000 ohms to the voice coil of the loudspeaker. Transformer mounting brackets are fitted to each loudspeaker.

For high sensitivity, brilliant response and large power handling capacity select the Rola 8M (P.A. Type).

It's a sound investment for Sound.

ROLA

LOUDSPEAKERS WITH ANISOTROPIC ALNICO

ROLA CO. (AUST.) PTY. LTD., The Boulevarde, Richmond, Victoria, and at 116 Clarence Street, Sydney.

GEO. BROWN & CO. PTY. LTD.,
267 CLARENCE ST., SYDNEY.

JOHN MARTIN PTY. LTD.
116-118 CLARENCE ST., SYDNEY.

NEWS AND VIEWS OF THE MONTH

British television drive

BRITAIN'S radio industry is now prepared to equip countries overseas with a television system which is claimed to be the best and the most economic in the world. As a first step, transmitters may, in some cases, be shipped abroad for demonstration purposes.

The recent announcement that Britain is to retain the 405 line definition system as the best available, has the unanimous support of the industry and has cleared the way for the all-out development of television in the United Kingdom and overseas.

A Television Advisory Committee, set up in the United Kingdom under the chairmanship of Lord Trefgarne, recently completed a review of every known television system in the light of the latest researches, and decided that the existing British system is the one on which to pin faith.

Policy decisions on television are not easy to make, and the committee tried to foresee developments very fare ahead and to consider what system was likely to fit in best with future applications to broadcasting and to large screens in cinemas. In spite of every consideration, the committee voted for further extensions in the British system now in use, and the BBC are now working out proposals for further stations in the United Kingdom so as to make television ultimately available to the greater part of the population.

Television manufacturers in Britain have many strong reasons for confidence in the success of their new drive. Not only is it recognised that the UK has the finest day-to-day television service in the world, but the industry is able to meet the present needs of the potential television buyer. The chief requirements for television development are high picture quality and moderate price. As far as quality is concerned, the great success of the Olympic Games television by the British Broadcasting Corporation has proved to international audiences that excellent clarity, definition and general quality of picture are ensured by the 405-line system. It has also been established that the British system is the best engineering compromise between maximum picture quality and minimum cost in production.

Lord Trefgarne has declared: "British scientists, who have led the world so far in television and radar, have research laboratories which may be relied upon to miss nothing, but in spite of all their knowledge of, and work on, the possible systems of the future, they have advanced conclusive arguments in favor of the present 405-line system. I believe, therefore, that any country pinning its faith to the British system will be putting itself in a most favorable position to take advantage of future development."

Television soon?

ACCORDING to newspaper reports, some television activity might be expected in the capital cities in about two years time.

We would be inclined to regard

RADIO CROSSWORD PUZZLE No. 13

ACROSS

3. Units of force.
7. Thermo——.
8. Lacking continuity.
9. Cone-shaped.
10. Stationary portion.
12. Flying toy.
14. Scold.
15. Greatest value of alternating quantity in one polarity.
18. Capacitor.
21. Institute of Radio Engineers (abbr.).
22. Smallest particle of elementary substance.
23. Interference.
26. Type of rays.
28. Television term.
29. Three-element tube.
30. Type of circuit.

DOWN

1. Unit of E.M.F.
2. Type of tuning.
3. Logarithmic .....
4. Not.
5. Valve support.
6. Tried out.
10. Sound.
11. Inert gas.
13. Regularly reverse direction.
16. Essential measures.
17. Delightful regions.
19. Science of light and vision.
20. Require.
24. Plant.
25. Type of current.
27. Greek symbol for dielectric flux.

BELOW: LAST MONTH'S SOLUTION

B	A	S	K	E	T		S	C	A	R		S		
A		P		L		E		H		E		Y		
F	L	E	M	I	N	G	V	A	L	V	E	S		
F		C		T		E		S		E		T		
L	E	T	T	E	R	S		S	E	R	V	E		
E		R				T		I		B		M		
	V	O	L	T	S		U	S	H	E	R			
L		M		O		F				R		Y		
O	M	E	G	A		L	I	N	K	A	G	E		
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E	L	E	C	T	R	O	O	P	T	I	C	S		
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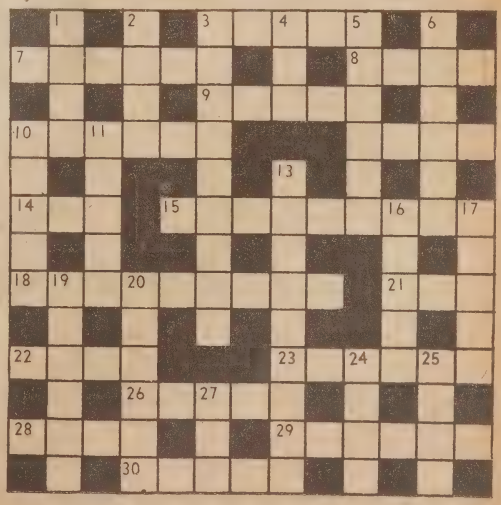
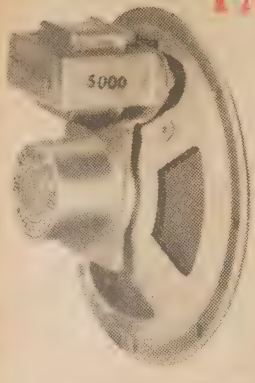
Z		S	U	R	E		B	R	A	N	L	Y		



The Latest Addition to the range of

FAMOUS KINGSLEY SPEAKERS



5" Permag.

TYPE KR5

The KR5 Speaker is the latest addition to the already famous range of Kingsley Radio Speakers. Illustrated at left—This Kingsley Speaker has new and improved seamless cone. Imported British magnet, featuring "Alcomax 2"—the highest grade magnetic alloy made. Cadmium plated housing. Standard mounting. Full-size matching transformer.

Available any desired impedance.

Retail Price 29/6

Write for full details of the KR5.

New Miniature

DUAL WAVE COIL UNIT

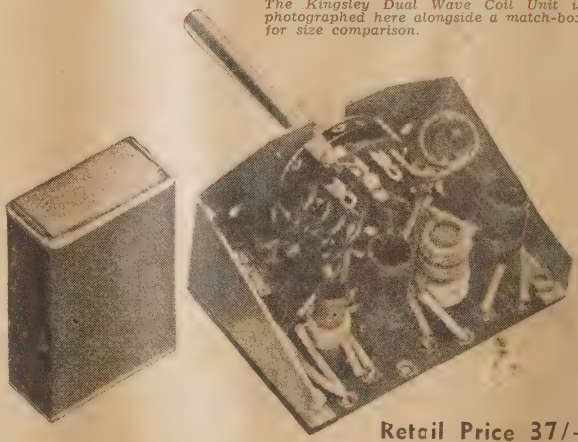
This new Kingsley Dual Wave Coil Bracket has not merely been reduced in size—it has been thoroughly designed by Kingsley's Research Engineers. It is no mere adaptation of existing components, being engineered not only from the electrical but also the mechanical viewpoint.

No Other D/W Bracket gives All These Features:

- Each unit is core tuned.
- Models for every converter valve.
- Frequency coverage 5.95 megacycles to 18.5 megacycles and 540 to 1650 kC/s.
- Trimmers and cores are readily accessible.
- Coils and wiring well protected.
- Dimensions of unit: 3 ins. wide 2 ins. deep, 1¾ ins. high.
- Ease of wiring into chassis.
- Sturdy construction of unit.

Write for further Details.

The Kingsley Dual Wave Coil Unit is photographed here alongside a match-box for size comparison.



Retail Price 37/-

KU3 DUAL WAVE COIL UNIT

IMPORTANT If your usual supplier is unable to supply your requirements of Kingsley Products, drop us a line mentioning his name and address.

Ask for—Insist on—DEMAND Genuine Kingsley Radio Parts from your supplier.

KINGSLEY QUALITY RADIO PRODUCTS

KINGSLEY RADIO

KINGSLEY RADIO PTY. LTD.

580 St. Kilda Road, Melbourne, Victoria . Phones: MX 1159, MX 3653

this as a minimum period for such activity, unless there are factors operating which might inspire a special effort. For instance, television stations might be of great value in case of national emergency, and with the affairs of the world as they are at present, such a possibility must always be kept in mind.

There is, of course, more to it than a mere service. It will mean that Australian engineers and manufacturers will have a chance to learn about television at first hand, and absorb the principles of a technique which might have many other applications. These are valuable by-products of anything new, and present an unassailable argument for doing the job ourselves if it can possibly be managed.

GOVERNMENT CONTROL

On the political side, there are many who do not like the principle of complete Government control of television or any other such service. This opinion has no connection with any party feeling. It has its parallel in the commercial plus national broadcasting setup, which on the whole seems to be an excellent system. Television will possess a powerful propaganda punch, and Australians aren't very keen on being the eternal recipients of such. The principle of free and independent expression is merely consistent with a democracy.

We hope, therefore, that even though Government sponsorship might be the best and in fact the only obvious method to launch television services, commercial broadcasters will eventually be given the opportunity to share it.

It would still seem, however, that the initial hurdle of making Australian television worth seeing must be successfully surmounted before many services can be supported. We might yet find that only the Government through a special licence fee, can afford to pay for decent programmes. Much bad television would be infinitely worse than none at all.

★ ★ ★

Our F.M. plans

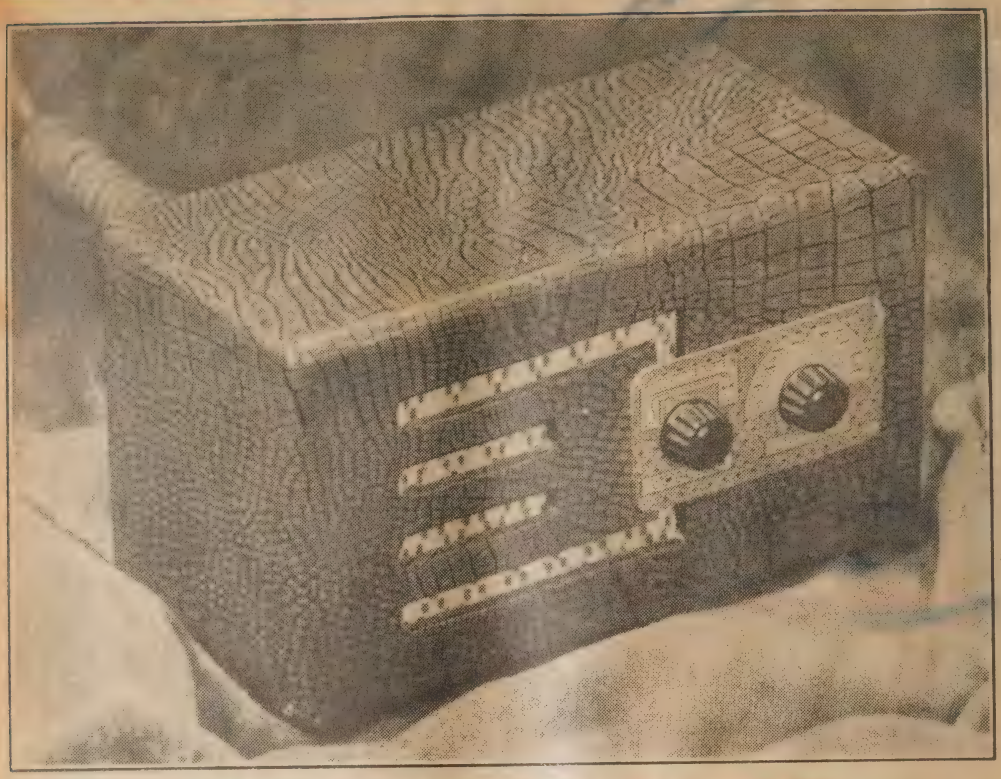
AT last the Prime Minister has announced the Government's plans for F.M. broadcasting in Australia.

While we agree that there is no particular reason to delay its introduction, we cannot see the logic in restricting it to the ABC.

If the public is to be encouraged to use F.M., they must be given every incentive to do so, and this includes a choice of programmes. To force them to hear only the ABC or to stay with A.M. won't provide this incentive, as most Australian listeners now prefer commercial programmes.

The net reaction to the announcement is an uneasy feeling that the Government has taken the first step towards the nationalisation of broadcasting. Certainly they have made it quite clear that the commercials can expect no consideration in the future. The inference is that they are, therefore, on the way out. Most Australians won't like it.

PUT THIS FORMULA
to work for you
I = E / IRC
This formula is a favourite and easily-remembered solution to resistance problems. Radio and electronic engineers know that I.R.C. offers the most complete line of resistance products in the industry . . . a fixed or variable resistor for almost every requirement . . . with uniform dependability proved by years of rigorous laboratory and field tests.
Purchasing agents and material control executives like I.R.C. service . . . "on time" deliveries . . . stocks of the most popular types and ranges from which they can draw . . . providing speedy "round-the-corner" service for small or large order requirements.
IRC RESISTORS
Sole Agents for Australia
Wm J. McLELLAN & Co.
BRADBURY HOUSE, 55 YORK STREET, SYDNEY BX 2508



The set is particularly neat, and can be tucked away in all kinds of convenient places.

THE 4/48 MANTEL SET

Not only is this our smallest mantel set to date — a real baby—but it introduces a new circuit technique using single ended valves and a copper oxide second detector. It uses the Minivox cabinet, but is a much more powerful set — a performer hard to beat for its size. It's the four valve set of the year!

by W. N. Williams

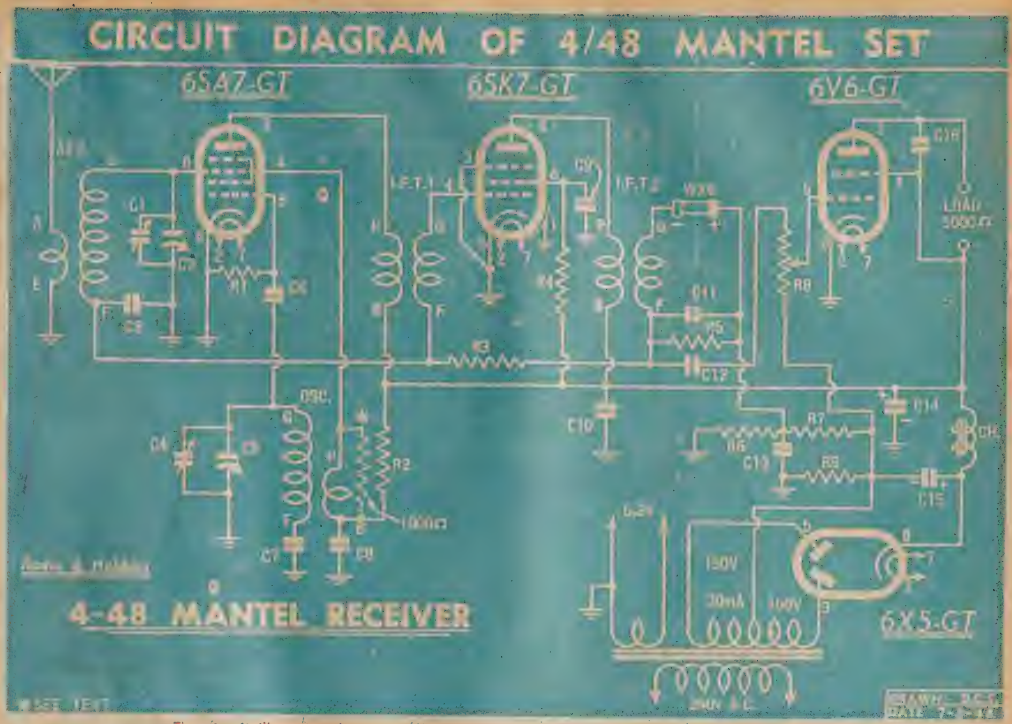
AT the moment, the whole position of miniature a-c sets is indefinite and reminiscent of the uncertainty which surrounded the design of personal portables a couple of years back.

Since about 1939 the design of mantel receivers has been more or less static, a good example being our own "Little General." Nearly all mantel sets, home-made or factory-built, have used a converter, I.F. amplifier/diode detector, output valve and rectifier. Cabinet styling has been subject to change, but the basic problem has been to fit the necessary components around four standard valves, whose overall length has set the minimum height of the cabinet.

A couple of years back there was talk of a complete locally-made range of "—GT" valves and designers turned their attention to layouts and styling which would take advantage of the reduced valve dimensions. We duly sighted the 5Y3-GT, 6X5-GT and 6V6-GT, but the remaining types did not make an immediate appearance. While an individual can build a receiver using hard-to-get valves, where necessary, no designer on a large scale can proceed unless he is perfectly sure that all valves will be to hand when required. And so it is that few mantel sets have appeared with "—GT" valves throughout, most of them still using a conventional converter and I.F. amplifier.

In the meantime F.M. broadcasting has arrived—at least in experimental form—and valve manufacturers are faced with a potential demand for valves still smaller than the "—GT" types.

The immediate need is not so much to make smaller cabinets possible as it is to achieve lower valve capacitances, shorter leads, smaller size and all the other attributes which are necessary in a valve, to operate well at VHF. The fact that such miniature valves can be used equally



The circuit illustrates the use of the Westector, and shows how simple the set really is.

well in still smaller mantel sets is, of course, interesting and poses an additional problem for the designer of small A.M. receivers.

Latest information on the subject indicates that standard equipment types for 1949 will include the 6BE6 miniature converter, 6BA6 R.F. pentode and 6AV6 diode-triode. For the output valve and rectifier we will be obliged for the time being to use the 6V6-GT and either the 5Y3-GT or 6X5-GT.

VALVES SCARCE

While all this is very interesting the plain facts of the matter are that none of the miniature valves are available in quantity at the moment, while supplies of the "—GT" types are limited in some cases. We can readily understand, therefore, why set manufacturers have not rushed into production with anything radically new in the way of mantel sets.

For our own part the position is not quite so critical in that, having pointed out possible supply difficulties, we can go ahead to build and describe a new receiver without bothering about production lines, standing time and all the other things which are the worry of production heads. Anyone having the necessary parts can duplicate our design.

Faced with many requests for a superhet equivalent of "Minivox," we simply had to make up our minds whether we would go ahead despite valve difficulties or simply shelve the whole proposition for six or maybe twelve months. In words of two syllables, we decided to go ahead.

Then we found ourselves again at a full stop, for neither the "—GT" series nor the proposed miniature range includes a diode-pentode and it looked for the moment as if our well-tried "Little General" circuit would have to be shelved for all time—or at least until local manufacturers obliged with a suitable valve.

At this juncture we remembered the "Westector," which found a limited use in battery sets before valve manufacturers released the 1B5, 1K6 and their octal counterparts. Here it seemed was the answer to the problem and a telephone call to distributors revealed that they were available in a new miniature form and cost only a few shillings retail. The more we thought of the idea the better we liked it.

Unless a diode-pentode is released it looks as if the majority of midget mantel sets will end up with a "Westector" and the chances are that they will make their appearance in F.M. receivers as well. So for a review of the complete circuit.

PARTS LIST

1 Cabinet (as for "Minivox")
1 Chassis 7¾in. by 4in. by 1in.
1 Bracket 3¾in. by 2in. with a ¾in. foot.
1 Miniature 2-gang, approx. .0004 mfd.
1 3in. speaker with 5000 ohm transformer.
1 Small aerial coil.
1 Small oscillator coil.
2 Midget IF transformers, 455kc.
1 Power transformer 150v. at 30mA. 6.3v. at 2A.
1 Small filter choke, type 6/60 or similar.
4 Small octal sockets, wafer type.
1 "Westector" type WX-6.

RESISTORS

R1 .02 meg.
R2 .01 meg.
R3 1 meg.
R4 .03 meg.
R5 .25 meg.
R6 .1 meg.
R7 .25 meg.
R9 300 ohms.
R8 1 meg. potentiometer.

CONDENSERS

C1 Gang trimmer.
C2 Section of gang.
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C10 .1 mfd. 200 volt tubular.
C11 .0001 mfd. mica.
C12 .01 mfd. mica.
C13 .1 mfd. 200 volt tubular.
C14 16 mfd. electrolytic.
C15 8 mfd. electrolytic.
C16 .005 mfd. mica.

VALVES

1 6SA7-GT, 1 6SK7-GT, 1 6V6-GT, 1 6X5-GT.

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2 knobs, 2 tag-strips, 2·3in. ¼in. bolts (for securing of filter choke and speaker transformer where this transformer is not mounted on speaker), hook-up wire, power flex and plug, nuts, bolts and solder lugs, &c.

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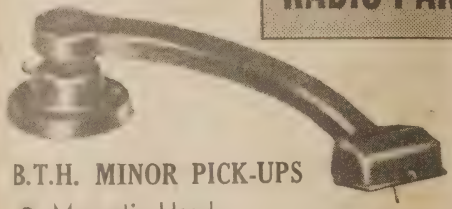

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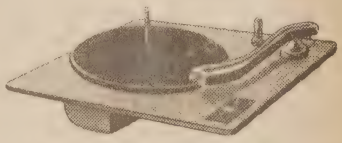

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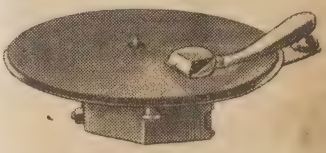

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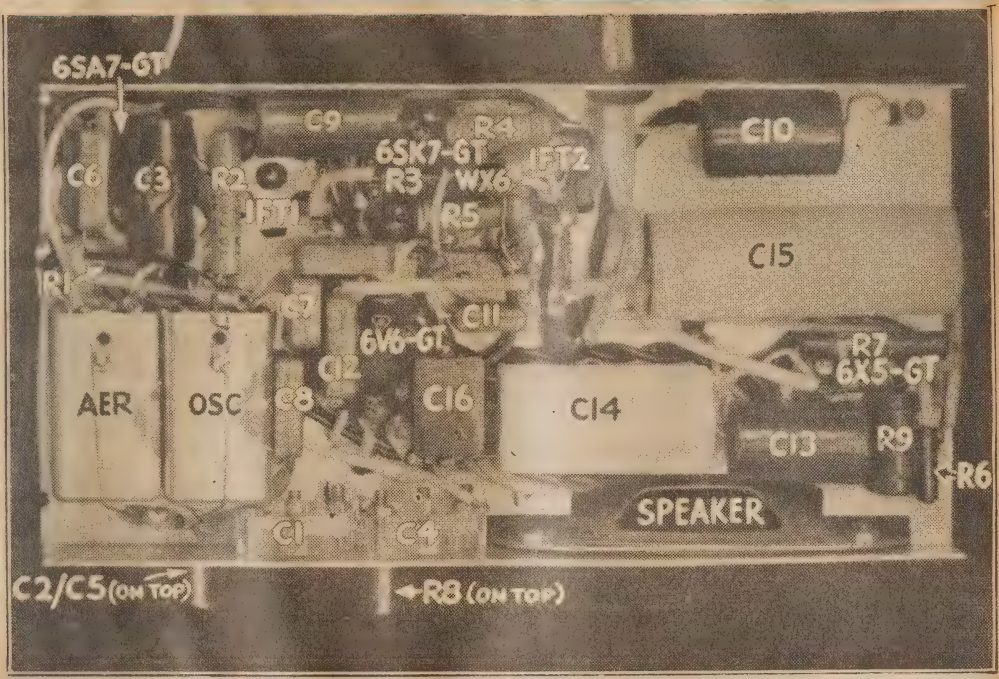
UNDER CHASSIS LAYOUT OF 4-48 MANTEL SET



More care is needed when making a small set to ensure suitable placement of parts. This keyed photograph will help you in the wiring up of your 4-48 receiver.

THE converter is a 6SA7—GT, which appears for the first time in any of our circuits. Like all other single-ended converters, it has no separate oscillator anode, the inner screen serving in this role. The oscillator circuit is, therefore, similar to one we have used several times for the 1R5, the screen being returned to its normal supply through one winding of the oscillator coil.

An important point about the 6SA7-GT is that the oscillator transconductance is about 4700 micromhos, compared with about 1500 micromhos for valves like the 6A8-G and the 6J6-G. A conventional oscillator coil will, therefore, be over-coupled for the 6SA7-GT and give excessive grid current. If a special oscillator coil is not available, therefore, the grid current can be brought within normal limits by deliberately loading the oscillator coil with a non-inductive resistor. In the original set this needed to be 1000 ohms for a grid current of approximately 0.5 milliamp.

MINIATURE CONVERTER

The 6SA7-GT was planned originally for local production, but indications are that it is to be superseded as an equipment type by the "6BE6"—a miniature button-based valve. The two valves are similar electrically, and, if difficulty is encountered at any time in procuring the 6SA7-GT, it can be replaced easily by a 6BE6. A check on the characteristics of the latter valve indicate that the transconductance of the oscillator section is 7250, so that even less coupling will be required in the oscillator coil than for the 6SA7-GT. This, of course, has been arranged with a view to FM applications and its requirements on the broadcast band are yet to be studied.

In the IF channel midget transformers are used for the obvious reason that large ones cannot be accommodated on the chassis. The IF amplifier valve is a 6SK7-GT, which has a transconductance slightly in excess of 2000 micromhos.

The high transconductance of the 6SK7-GT, in conjunction with the high gain miniature transformers necessitate some care with layout and wiring, if actual instability is to be avoided. It is essential to mount the transformers and the 6SK7-GT socket in such a way that the leads to plate and grid are short and direct.

No valve shields are shown in the photographs, but, in practice, we found it desirable to slip a shield over the 6SK7-GT. This valve is already shielded internally, and by means of the metal sleeve base, but some advantage was found from adding an external shield, which slips over the envelope and earths to the base. The base sleeve and the internal shielding connect to pin-1 of the socket.

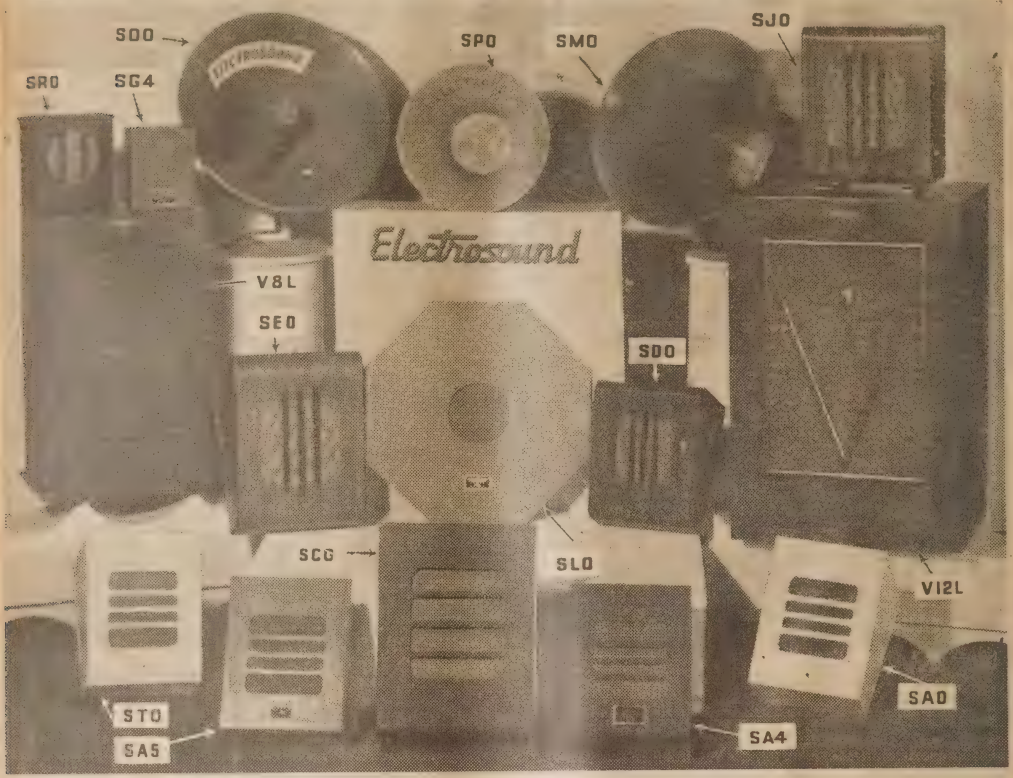
It is necessary to earth pin-1 of the 6SK7-GT socket as well as the cathode and suppressor connections. The cathode of the 6SA7-GT is likewise earthed, as also is one side of the heater circuit. Bias for the two valves is picked up via the AVC line, while the screens are fed separately in the interests of stability.

THE DETECTOR

Special interest centres in the detector circuit, which, as previously mentioned, uses a Westector type WX-6. In appearance the Westector resembles a half-watt resistor, with one end painted red. This end is positive and it is most important to connect it in the manner shown by the circuit, as otherwise it will apply a positive rather than a negative voltage to the AVC line. It is important also to use a WX-6 rectifier, which has a 36-volt rating. The WX-1, which is recommended for crystal sets, has only a 6-volt rating and application to a superhet circuit may cause breakdown.

Actually, the Westector connects into circuit in exactly the same fashion as a diode, but has the additional advantage of its own "cathode." This "cathode" is returned in the 4/48 circuit to a point on the back bias network, which supplies an initial bias of approximately three volts to the grids of the

Electrosound Range of Speaker Boxes



TYPE NO.	SPEAKER SIZE	DESCRIPTION	FINISH	PRICE
SAO	8"	Box, open back, solid wood, straight edges, sloping front, 11" x 14" x 7" less speaker.	Grey or Cream	£2/5/0
SA4	8"	As SAO, but fitted with 8" Rola loudspeaker, "on-off" switch and compensating resistor.	Grey or Cream	£5/1/3
SA5	8"	As SA4, but fitted with attenuator type volume-control with "off" position.	Grey or Cream	£6/6/3
SCO	12"	As SAO, but larger, 13" x 17" x 8".	Grey or Cream	£3/15/0
SDO	8"	Box, open back, veneered ply wood, curved top and bottom, sloping front, 11½" x 13" x 6½".	Walnut Polished	£3/2/0
SEO	12"	As SDO, but larger—13½" x 17" x 8".	Walnut Polished	£4/1/0
SG4	5"	Box, enclosed, Metal, louvred front and sides fitted with 5" Rola loudspeaker, "on-off" switch and compensating resistor, 7" x 8½" x 3½".	Grey crackle	£3/5/0
SJO	12"	Box, with back, table, wall or ceiling mounting, veneered plywood, 13½" x 17" x 7".	Walnut Polished	£4/19/0
SLO	8"	Flat baffle, octagonal, plywood 24" x 24" x ¾".	Grey or Cream	£1/4/0
SMO	8", 10" 12"	Horn, wide angle, with mounting and swivel bracket complete with 2-pin polarized plug.	Grey lacquer	£5/15/6
SOO	Driver	Horn, Reflex exponential, with mounting bracket, 5ft. air column.	Grey lacquer	£11/16/9
SPO	8"	Horn, wide angle, short range, with mounting bracket.	Grey lacquer	£2/19/0
SRO	8"	Box, open back, solid wood, leather-covered, straight front, 9½" x 9½" x 5".	Brown leather	£1/15/0
STO	8"	Box, open back, solid wood, straight edges, sloping front, similar to SAO, but with angle cut left or right, 11" x 14" x X (as required).	Grey or Cream	£2/9/6
V8L	8"	Vented enclosure, solid wood, straight edges, lined hair felt, duct on air vent, screwed and glued, 18" x 30" x 12", 5-8" timber.	Grey lacquer	Prices on application
V12L	12"	As V8L, but larger, 24" x 36" x 16", 5-8" timber.	Grey lacquer	
V12P	12"	As V12L, 24" x 36" x 16", 1" timber. (Not illustrated).	Walnut Polished	

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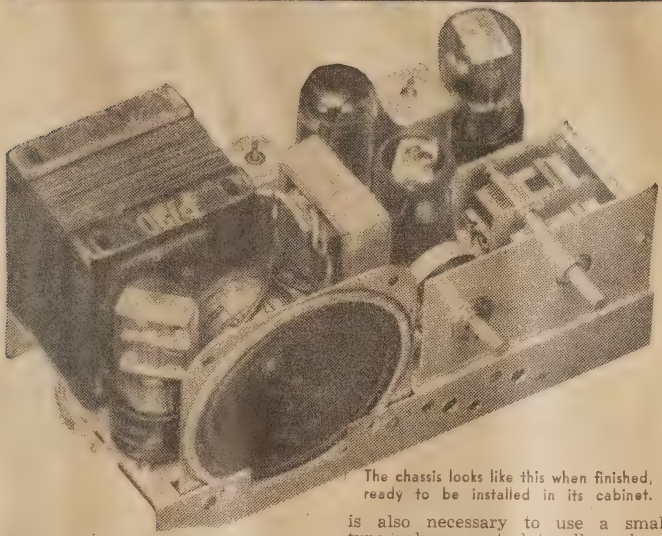
GENERAL VIEW OF 4-48 CHASSIS



The chassis looks like this when finished, ready to be installed in its cabinet.

6SK7-GT and 6SA7-GT. With an incoming signal, the Westector generates the additional AVC voltage.

The audio output is taken, as usual, from the bottom of the IF transformer secondary, through a volume control, to the grid of the 6V6-GT. The lower end of this control is returned also to the back-bias network, allowing the 6V6-GT cathode to be earthed. No tone control is provided, of course, but a .005 mfd. condenser between plate and screen offsets the tendency for the diminutive speaker to accentuate the higher audio frequencies.

POWER SUPPLY

The power supply uses the now familiar P/30 transformer, 6X5-GT rectifier, filter choke and condensers.

The chassis has the same overall dimensions as for the original "Minivox," namely, 7¾in long by 4in wide by 1in deep. The components are much more crowded, however, and, as in all miniature designs, it is essential to take great care with the layout. The smaller the set is, the less flexibility there can be in the choice of components.

With this in mind, it is essential to purchase the smallest wafer sockets now available, preferably mounting them on the chassis, with countersunk head bolts. Only miniature IF transformers will fit in, some types being locked by a centre screw, others by lugs, which bend over beneath the chassis and solder to the earth wiring.

The 6SA7-GT, 6SK7-GT and the two IF transformers mount quite nicely along the rear of the chassis, and the 6V6-GT tucks into the space between the tuning gang and the filter choke. The placement of the 6V6-GT is quite critical, since it is likely to have a clearance of only 1-16in from the choke and the same distance from the rotor plates of the gang when in the open position. It is also necessary to use a small type volume control to allow clearance for the rotor plates. Certain imported English condensers will allow slightly more clearance, but we considered it advisable to design around the Australian type.

The space between the volume control and gang spindles is set at 1 5-8in by the design of the dial indicator plate. With the edge of the gang flush with the edge of the chassis, you will find that the spindle holes are somewhat nearer the end of the cabinet than originally intended for the Minivox, but the dial plate will easily cover any modifications which may have to be made to the cabinet. The gang condenser attaches at the front to the mounting plate, and at the back by a couple of small brackets, which you will need to make up.

It is essential to use a miniature filter choke and, to conserve space, the output transformer and filter choke are mounted one above the other. This mounting can be easily arranged by a couple of long bolts or mounting pillars, the spacing being arranged to bring the top of the output transformer roughly level with the top of the power transformer.

RECTIFIER POSITION

There is just room to mount a miniature loudspeaker in front of the power transformer, while the 6X5-GT rectifier tucks in to the vacant space at the other side of the loudspeaker. There is nothing very radical about this layout, and you should have no particular difficulty in mounting all the components. The heat dissipation is comparatively low and presents no problem.

Underneath the chassis care is likewise necessary if all the components are to mount conveniently in place.

The aerial and oscillator coils are of the miniature variety, in 7-8in square cans. These are mounted

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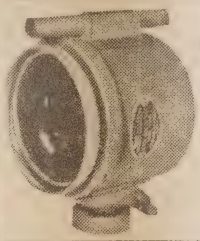

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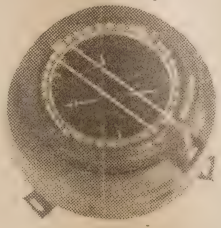

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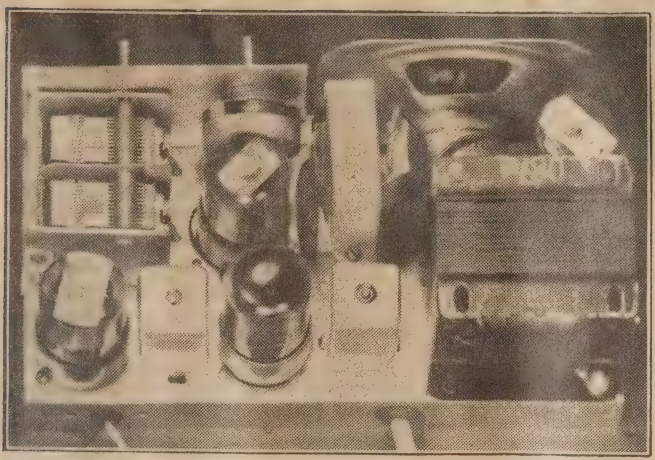
PLAN VIEW OF 4/48 CHASSIS



And lastly a plan view of the chassis from which the placement of parts can clearly be seen.

in rather an unusual, but perfectly legitimate fashion. Two holes are provided in the chassis, through which the one mounting lug may be bent and folded back before the gang is mounted in place. The opposite ends of the coils are held down in each case by a piece of busbar, which solders to a double-ended lug and passes over the top of the can to anchor on the unused mounting lug. By the time you solder various leads in place you will find that the coils are very firm indeed.

It is necessary to place the components around the converter socket, so that they will not protrude below the bottom of the chassis nor prevent adjustment to the iron slugs through two small holes in the rear of the chassis. The aerial, incidentally, comes out through a grommet between these two adjusting holes.

ANCHOR POINTS

The exact position for the remainder of the components is clear from the underenath photograph, and it is noteworthy that anchor points are provided for some of the wiring and components by a two-position and a three-position strip near the centre of the chassis. Pin-6 of the 6V6 socket is used as an anchor point for the grid wiring, while several pins of the 6X5-GT socket can also be used as anchor points.

Use small mica condensers and small resistors throughout, also 200-volt tubular condensers; watch the polarity of the Westector and join all earth points together, in case one of them is making faulty contact to the chassis.

The gain of the receiver is quite high, despite the moderate operating voltage and current and it is essential to take care with the layout to avoid unduly long grid and plate leads. A shield on the 6SK7-GT is helpful in some cases, likewise a shield on the 6SA7-GT, duly earthed to the chassis. If instability is encountered and it is found impossible to stabilise the set by ordinary means, the screen voltage may be reduced by increasing the value of the screen resistor. Alternatively, the standing bias may be increased slightly by decreasing the value of resistor R7. However, these are emergency measures, which should not be necessary, the preferred method being to discover and rectify the real cause of the instability.

The alignment procedure is quite standard, instructions being available if necessary through the shilling query service.

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Midget Valve Sockets 7d &	11d.
Midget ½ watt Resistors (to 3 meg.)	9d.
Midget 1-3 watt Resistors 10 meg. (USA) ..	1/4
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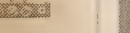

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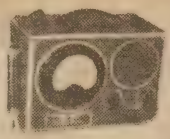

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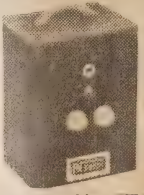

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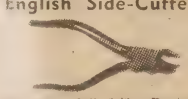

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1S5	20/6	6C5	19/3	6X5	20/10
1S4	20/6	6F6	17/10	7C7	17/3
1T4	20/6	6F8	21/3	12SF7	19/3
2X2	12/9	6G6	20/9	12SK7	19/3
3S4	20/6	6H6	19/3	12SQ7	18/4
3V4	20/6	6J5	16/9	80	14/7
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How Gas Is Made

(Continued from Page 13)

ful substances in existence. It is a compound of complex organic materials from which the chemist seems to be able to get anything he wants.

Actually coal tar consists of only about a dozen or so primary substances, but from these many thousands of new substances can be built up.

The tar is distilled in large cylindrical iron stills by the fractional distillation process. This means that certain of the constituents vaporise at certain definite and different temperatures, and as the temperature is raised these substances come off in their order.

The first fractions are light oils such as benzol, toluol, and xylol, all spirituous substances.

The next fractions include carbolic acid and the cresols and phenols. Then come fractions consisting of naphthalene, creosote oil and quinoline, and the last fraction is anthracene oil.

DYES FROM COAL

From benzene or benzol the wonderful array of colors of aniline dyes is made. It also yields artificial oil of bitter almonds, used in perfumery.

Toluol gives us benzoic acid, a preservative; picric acid, used in explosives and as a dye; that very sweet substance used as a substitute for sugar, saccharine; and tri-nitro-toluene, a powerful explosive.

From the carbolic fractions are made salicylic acid, used in medicine; antifebrine, a fever remedy; coumarin, an artificial vanilla flavoring.

Naphthaline gives us indigo, buttercup yellow, green, pink and scarlet dyes.

Novocaine, a popular local anaesthetic, is made from toluene. Nocitinic acid, a popular remedy for chilblains, is a product of coal tar.

One of the most important discoveries of all time is the now well-known sulpha group of drugs, such as sulphanilamide, sulphadiazole, sulpha-diazine, sulpha-pyridine and many others. All these were made possible by the chemist's ability to change the molecules of coal tar substances.

Some popular plastic materials are products of coal tar derivatives. Bakelite is an example. This is made from the phenols.

Lastly, a number of fertilisers are made from coal tar, the most notable of which is ammonium sulphate.

Literally thousands of substances can thus be made from tar. The chemist, once he is furnished with the chemical skeleton formula of the molecule which he wishes to build, is able to so alter and modify it that it changes its chemical properties and a new substance is produced.

Thus it is that what starts out as a piece of coal is really a chemical storehouse of immense wealth which has conferred many benefits to mankind, and behind the walls of the gas works is a wonderland for the chemist.

With all its odors the gas works is a place we cannot get along without.

EVOLUTION AND. . .

78 R.P.M

REVOLUTION

33 1/3 R.P.M

A DUAL TURNTABLE WITH TWO-SPEED

RECORDING

From the now well-known "BRS" R12 Recorder & Playback Unit has evolved the need for a unit with two turntables, giving the facility of two-speed recording. Byer Industries Pty. Ltd. announce they have completed a number of units to fulfil this purpose. This unit gives the same facilities of recording and immediate playback as the R12 unit, with the addition of 2-speed recording on two different turntables. As only a limited number of dual turntable units are being produced, your immediate enquiry would be appreciated to ensure your requirements being fully met. Complete technical information will be supplied on request.

Designed for installation in any standard radiogram or for use with most types of receivers, the R12 is simple to connect and operate. A precision made sound instrument for recording and immediate playback, it is comparable to similar higher priced equipments.

Today, when you use the Byer R12 Recorder & Playback Unit with its smooth, silent operation, you are assured of perfect reproduction within the limits of the devices transmitting the sound. Byer Recording Blanks of commercial quality and moderately priced are available in any quantity. Write for full technical details.

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"BRS" R12 RECORDER & PLAYBACK UNIT

Here's your answer, Tom!

Last month we answered several questions sent in by a reader whom we introduced simply as Tom. We considered that the problems which had puzzled Tom may also have puzzled other readers. So here's the second part of Tom's letter answered in the same detailed manner.

TOM wants to know: Do short-wave or dual-wave stations usually have world range? If not what is a good indication?

Well, Tom, it is rather difficult to be specific about range since, under the best conditions it is possible to receive stations on a one-valve set from the other side of the world. So much depends, you see, on location, atmospheric conditions, the aerial and earth system, and the care with which the set is adjusted and operated. However, we can make a few general statements applying, first of all, to the broadcast band.

Broadly speaking, 1 valve and 2 valve reaction sets can be relied upon to give good earphone listening over a range from say 30 to 100 miles, assuming that you use a good aerial and earth system. Add a third valve, and you could expect loudspeaker results up to 70 or 80 miles, and interstate reception on earphones.

Reaction sets, however, always need a good deal of care to operate, and non-technical listeners usually succeed only in making them squeal madly and interfere with neighboring sets.

For simple operation, it is really necessary to go to a superhet circuit, which is the precise reason why they are employed universally in Australian homes.

A 4-valve superhet will generally give daylight loudspeaker reception up to 100 miles, and unlimited reception at night. For still better results, it is desirable to have a superhet with an R.F. stage, using a 3-gang tuning condenser.

All this refers to the broadcast band only. On short waves it is impossible to speak in terms of range, since stations from half-way round

the world can be louder under certain conditions than stations 100 miles away. It all depends on the time of day or night, season of the year, the frequency or wavelength of transmission, and the location of transmitter and receiver. If you want guidance on these matters, we can do no better than refer you to the short-wave pages in each issue.

However, our remarks about reaction and superhet receivers still hold good. A 1 or 2 valve reaction set is usually good for earphone reception, while a 3-valve reaction set will bring stations in on the loudspeaker if carefully adjusted. Superhet receivers are always simpler to tune, a 4-valve set being mediocre in its performance, and a 5-valve—with R.F. stage—being a much better proposition.

THOSE CYCLES

What are cycles, kilocycles, and megacycles, and how do they link up with meters and frequencies? (I know they are part of transmission, but that is about all.)

Phew! There's no doubt about you, Tom, you would make an excellent fast bowler if your special interest was cricket. Thank goodness, you don't set school exam. papers—or maybe you do!

The term "cycle" is applied to alternating current or, in other words, current which periodically reverses its direction of flow. It does this normally because it is generated by a mechanical device rather than a battery. For example, a cycle generator produces an alternating current or voltage by spinning a coil in a magnetic field, and the number of revolutions per second determines the number of changes (or cycles) in the flow of the electric current.

Most of the power mains in Australia deliver alternating current, the frequency generally being 50 cycles per second. However, alternating current or alternating voltage is not peculiar to electric light systems. Your brain responds to impulses from about 20 cycles to 15,000 cycles, and creates a sensation which you refer to as sound. Of course, this involves mechanical vibration in your ears, but we can't go into that. The point we are trying to make is that these "cycles" or alternations play a very real part in our existence and are not just something thought up by a mathematical or an electrical genius.

Above about 100,000 cycles per second, electrical impulses begin to radiate or travel in space as radio waves. This activity extends right through the broadcast, short-wave and ultra short-wave bands, to a point where our body becomes directly responsive to them, and we record a sensation known as warmth. Beyond that, heat rays merge into light rays, to which our eyes respond, and so on, through ultra violet, X-rays, &c.

Now we can get right back to your question. We have already explained a "cycle" as an alternation, and it can be said to take place so many cycles-per-second, abbreviated to c/s. When we have to speak of 100,000 cycles-per-second it becomes rather difficult

to express, and one can use the alternative term of 100 kilocycles, abbreviated to 100 kc/s., or simply 100 kc. You see, 1000 cycles are equal to 1 kilocycle. In just the same way, 1000 kilocycles are equal to one megacycle, making it possible for us to say 50 megacycles rather than 50,000 kilocycles.

Wave length in meters is the physical length of a particular radio wave in space. Low frequency radio waves have a long wave length, and high frequency waves a shorter wave length.

To convert wave length in meters into kilocycles, simply divide into 300,000 and vice versa. Thus a 300 kc. radio signal has a wave length of 1000 meters. Again, a 200 meter radio transmission has a frequency of 1500 kc. Hope you are still with us, Tom!

A BIG ONE!

What is meant by oscillation, and what is modulation?

There is no doubt you are a tiger for punishment!

Oscillation can be mechanical or electrical. Simple mechanical oscillation is represented by the pendulum of a clock which swings to and fro at a regular rate and is kept going by a tiny impulse from the main spring. Oscillation can occur in electrical circuits, currents flowing back and forth at a regular rate

and maintained in motion by a suitable electrical impulse.

All transmitters have an oscillator, which is an electrical circuit specially designed to produce oscillations at a definite frequency. These are amplified (or magnified) in later stages of the transmitter, and finally applied to the aerial as a radio signal of specific frequency and wavelength. As a matter of fact, the aerial circuit is designed to have definite electrical characteristics, so that it will itself oscillate electrically in sympathy with the signal fed to it from the transmitter.

Modulation is the process by which intelligence is applied to the radio frequency "carrier." It may be by voice or music, or by an audible tone.

An oscillator stage is necessary in a superhet receiver, but, apart from this special case, oscillation in a receiver is generally undesirable. It can cause whistles on stations or a continuous howl in the loudspeaker.

SHUNTS AND CHOKES

What are shunts and chokes, and what are their respective purposes?

We rather feel that there are a lot of other components which you could have included in this question, but that you just picked on "shunt and chokes" as the first ones which came to mind. However, we can only take you at your word, and, for the rest, refer you to the current series of articles for beginners.

Broadly speaking, a "shunt" is any circuit or component which connects in parallel with (or across) another circuit or component. However, the normal usage of the word applies it to a resistor which is connected across a meter movement to alter its range. Thus, a meter which normally reads 1 milliamp full scale can be "shunted" to read 10 milliamps, 100 milliamps, or any other required value, full scale.

Chokes are invariably coils of wire. Radio frequency chokes can have anything from a dozen to many hundreds of turns, depending on their purpose and wound either on a small bobbin or in "honeycomb" fashion.

Power or filter chokes used in the power supply circuits of mains or vibrator receivers are intended to carry anything from 10 to 250 milliamps and are wound on a laminated iron core. Audio chokes are also wound on an iron core, but generally have many more turns of finer wire than a filter choke.

TUNERS

What is meant by T.R.F. and superhet receivers, and what are the distinctions between them?

You are certainly in form, Tom; right up to the last question. Well, here goes!

The term "T.R.F." means "tuned radio frequency" and indicates a type of receiver in which all amplification ahead of the detector is provided at signal frequency That is to say, if you are tuned to a 1000 Kc signal, the circuits in the front end of the set are tuned to 1000 Kc and the valves amplify the signal directly before applying it to the detector. Here, of course, it is changed to an audio frequency and amplified further for application to the loudspeaker.

In a superhet receiver, on the other hand, the incoming signal is deliberately changed to a lower fixed frequency and amplified by a valve and coil combination referred to as the I.F. channel. It is then passed on to the detector, the audio amplifier, and, ultimately, to the loudspeaker.

For a beginner, the surest way to pick a superhet is to note the type of valves used, check through a valve list and note whether one of them is classified as a "pentagrid converter" or a "frequency changer" of some description. Most modern superhets have one such valve, while they would seldom be found in a T.R.F. design. The chief exception to this remark would be in little sets like our "Test Match Special," which uses a frequency changer valve, not for its original purpose, but simply because it has a lot of grids inside with which we can do strange things.

Well, that's that, Tom. Here's hoping that our remarks and explanations have helped you on your way to a better understanding of radio theory.

Movie Technique Cans Television Programmes

(Continued from Page 9)

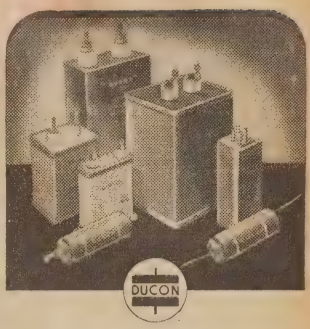
cost of 16mm for the same period of recording.

The current quality of television images, which will undoubtedly undergo gradual refinement, is considered to be roughly equivalent to 16mm home movies, although actually somewhat better with reference to contrast and detail. Recording on 35mm rather than 16mm film results in no marked improvement at the present time. Fire regulations covering the use of the wider film are also rigorous.

In producing television recordings in the NBC studios, Radio City, New York, programmes are piped by direct line to the kinescope tube. For programmes originating outside the studio, the programme is taken from the coaxial cable before the signals reach the Empire State transmitting station.

Printing of the film is done according to standard motion picture laboratory practice. Step-printing in which stock and negative are exposed to the printing light, a frame at a time, is preferred over continuous printing, where the negative and print stock run past an illuminated slit at a continuous speed.

Recording of the sound portion of a television programme is accomplished with standard 16mm sound-on-film recording equipment at the rate of 24 frames per second.



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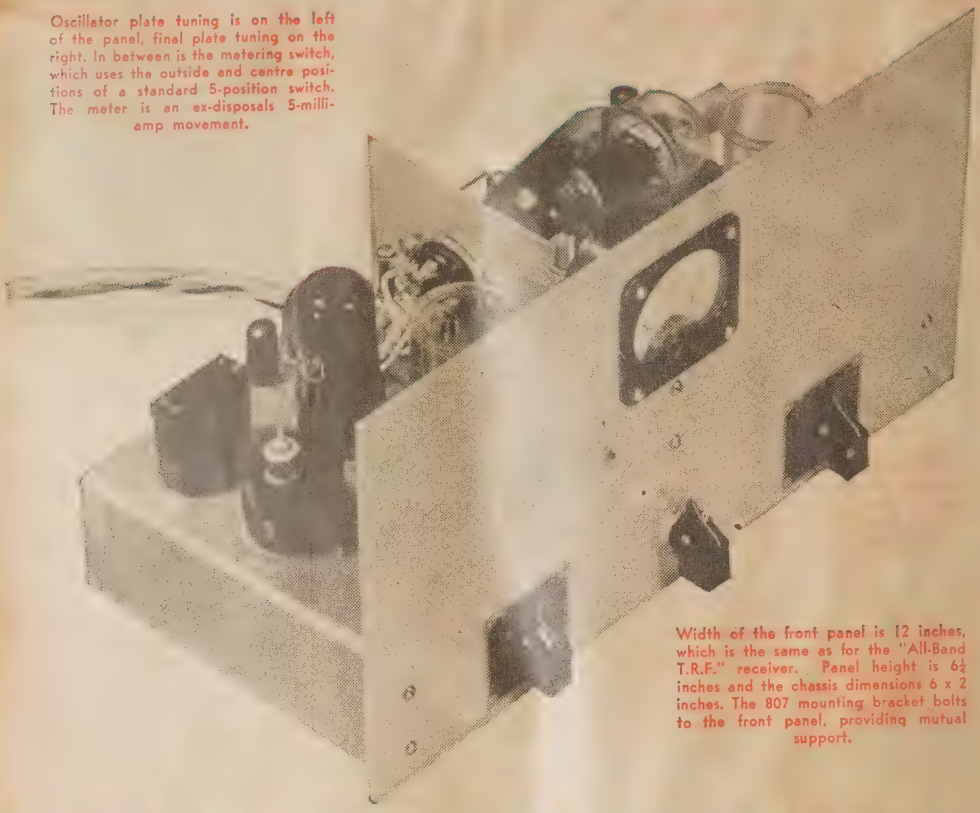


Oscillator plate tuning is on the left of the panel, final plate tuning on the right. In between is the metering switch, which uses the outside and centre positions of a standard 5-position switch. The meter is an ex-disposals 5-milliamp movement.

Width of the front panel is 12 inches, which is the same as for the "All-Band T.R.F." receiver. Panel height is 6½ inches and the chassis dimensions 6 x 2 inches. The 807 mounting bracket bolts to the front panel, providing mutual support.

A 2-VALVE TRANSMITTER

This little transmitter is just about the ultimate in simplicity, but it is nevertheless capable of putting an excellent signal on the air. A companion unit to last month's "All Band TRF," it represents an ideal "first rig" for the new amateur.

TO the new amateur, cost and simplicity are both important factors — the first one for very obvious reasons. On the second count, the simpler the transmitter can be made, the better for all concerned, since the newcomer usually has sufficient to occupy his mind for the first few weeks, without having to worry about the manipulation of cranky circuits. While fellow amateurs are usually sympathetic, there is always plenty of nervous tension associated with the first "flutter" on the key or the first few "rag chews" on phone. Not to mention, of course, possible trouble with feed-back, aerial matching and B.C.L. interference which does occur even in the best regulated circles.

The new transmitter, therefore, is very simple in design and its construction will normally present a less formidable task than the receiver which goes with it. If a few elementary rules are followed during the construction, there should be no question about it operating from the word "go." For all this, the circuit is versatile in its application and, by simple interchange of coils and crystal it will operate on any of the four popular lower frequency bands and has provision for either phone or C.W.

Reviewing the circuit you will note that a 6V6-GT serves as a tritet or "straight" oscillator, according to the arrangement of coils. The tritet is sometimes maligned as being hard on crystals, but there is no foundation for such a statement, if due attention is paid to operating conditions. In this case, the 807 requires so little grid drive, comparatively speaking, that the crystal should have a very long and comfortable life. Apart from the tuning adjustments, the governing factor in crystal current is the oscillator screen voltage and it is noteworthy that this is applied through a .05 meg dropping resistor.

Simple capacitive coupling is employed between the 6V6-GT plate and the 807 grid, while the plate and screen circuits of the 807 are quite conventional.

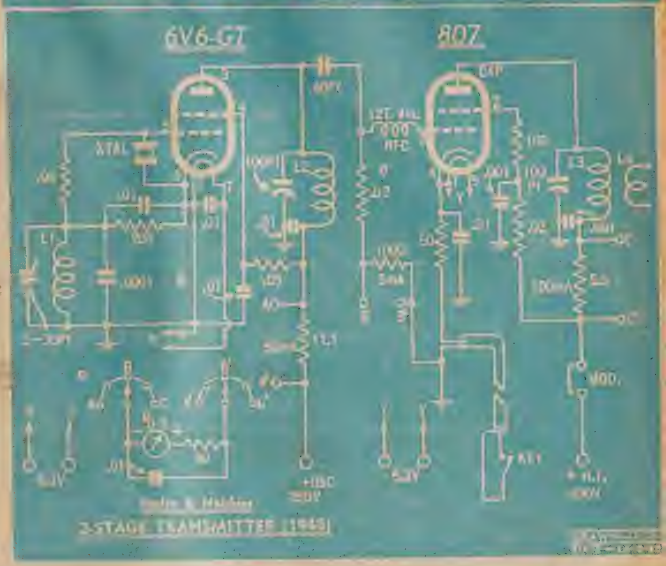
The tritet cathode coil L1 is wound on an ordinary large 4-pin valve base, the ends of the coil conventionally connecting to the two large pins. Underneath the chassis a 100 pf. condenser is wired across these same two pins.

When using a 7 mc. crystal L1 should consist of seven turns of about 16 B & S gauge wire with a 30 pf. variable trimmer connected across it and mounted inside the former. Thus the coil is tuned by the 100 pf. fixed condenser under the chassis plus the variable trimmer inside the coil itself.

For a 3.5 mc crystal L1 needs to have 12 turns of the same gauge wire close wound with a 100 pf. fixed condenser and a 30 pf. variable trimmer wired permanently across the coil inside the former. The 3.5 mc. cathode coil thus has a total tuning capacitance of just over 200 pf.

A feature of the circuit is that coils for positions L2 and L3 can be interchanged, so that only five in all are required to cover four amateur bands. The key to coil positions and the winding data are tabulated below.

SCHEMATIC CIRCUIT DIAGRAM



For straight-through operation on either band, a third coil plug is required, carrying a shorting link between the two large pins. The cathode and crystal circuits are therefore returned direct to earth, which is normal and necessary for fundamental output in the plate circuit. The 200 ohm cathode resistor and the .01 mfd bypass limit the current through the 6V6-GT if crystal excitation is removed, but in the normal way, the screen voltage is so moderate that the two components are more in the nature of a technical nicety than a necessity.

The coils for positions L2 and L3 were wound, for the original transmitter, on 1¼in diameter, 6-pin trolitul coil formers. The coils could, of course, be wound on ordinary valve bases for L2 and micanol bases for L3, but the 6-pin trolitul formers are standard nowadays and probably the best choice.

PLATE COILS

For all-band operation, it would appear necessary at first glance to have eight coils for positions L2 and L3, but, by suitable choice of inductance and capacitance values, the coils can be interchanged from one position to the other, so that only five in all are required.

The details of the individual coils and their positions for different operating frequencies are set out in the accompanying table.

The exact arrangement of the pin connections does not matter a great deal, the most important point being to arrange the wiring to be the same for both sockets—positions L2 and L3.

Select two suitable pins for "P" and "B-plus" and two others for the output coupling link. There will be no connection to these latter pins in position L2, but they will connect to the aerial feed when the same coil is plugged into position L3. One of the remaining blank pins on socket L3 can be used for a simple switching operation, as we shall see presently.

This latter point is important when a transmitter is to be modulated.

The required capacitance can be provided easily by bridging an additional 100 pf. fixed mica condenser across the final plate tank. The condenser can be connected, for example, across the coil socket from earth or B-plus to a vacant pin. A link from the same pin to plate, inside coil E only, will bring the condenser into circuit whenever this coil is plugged into socket L3.

This is the only simple bridging operation which needs to be arranged but make sure that you do not complicate matters by inadvertently using as an anchor point a socket lug which makes connection to the extra condenser or a coupling link.

COIL DATA

Checking through the coil data, the first line gives details of straight-through operation on 3.5 Mc.

It is, of course, necessary to use a 3.5 Mc. crystal and the oscillator does not need a resonant cathode circuit. Therefore the shorting link classified as "coil A" is plugged into the L3 socket.

The plate circuit of the oscillator must be resonated to 3.5 Mc. and this is achieved by plugging coil D

COIL DATA

Crystal Freq.	Output Freq.	For L1 Use coil:—	For L2 Use coil: —	For L3 Use coil:—
3.5	3.5	A	D	E*
"	7	B	E	F
"	14	B	F	G
7	7	A	E	F
"	14	C	F	G
"	28	C	G	H

* With socket wired to connect extra .0001 mfd mica in parallel with coil.

Coil A—Shorting link.

Coil B—12 turns, close wound on 4-pin valve base, with 100pf mica and 30pf trimmer in parallel and inside coil former.

Coil C—7 turns, close wound on 4-pin valve base, with 30pf trimmer in parallel.

Coil D—34 turns, close wound.

Coil E—19 turns, close wound, 5-turn link inside.

Coil F—12 turns, close wound, 4-turn link inside.

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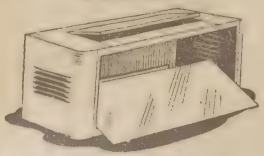

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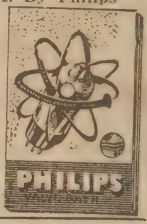

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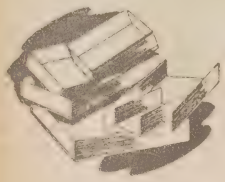

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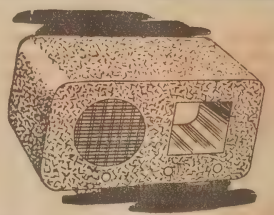

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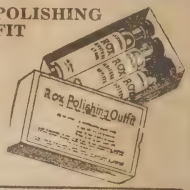

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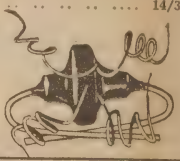

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into socket L2 and turning the 100 pf. tuning condenser well in towards its maximum capacitance. Coil E, which has fewer turns, plugs into the L3 position, and, according to a simple calculation, needs to be resonated with about 190 pf. to give an optimum circuit "Q."

The remaining coil combinations for the different bands follow more or less automatically. It is noteworthy that the final "tank" resonates on each band with considerably more capjacitance than the grid coil, the reason being to obtain something like optimum "Q" factor in each case.

COUPLING LINKS

As far as the coupling links are concerned, it is possible to give approximate data only, as the optimum number of turns and the degree of coupling depend on the impedance of the coupling circuit and the nature of the aerial itself.

The metering circuit also warrants special comment. The meter itself has a 5-milliamp movement and is of a type which has been sold by the thousands in disposals equipment Some meters are calibrated directly 0-5 milliamps, while others serve as voltmeters and have built-in multiplier resistors. Removing the resistors will generally leave a 5-milliamp movement with a coil resistance of about 10 ohms.

Instead of purchasing critical, low value shunts, the meter circuit resistance is first built up to 100 ohms by connecting a 90 ohm resistor directly in series with one lead. You may be able to obtain a 90 ohm resistor to order or simply select one from a batch of nominally 100 ohm resistors.

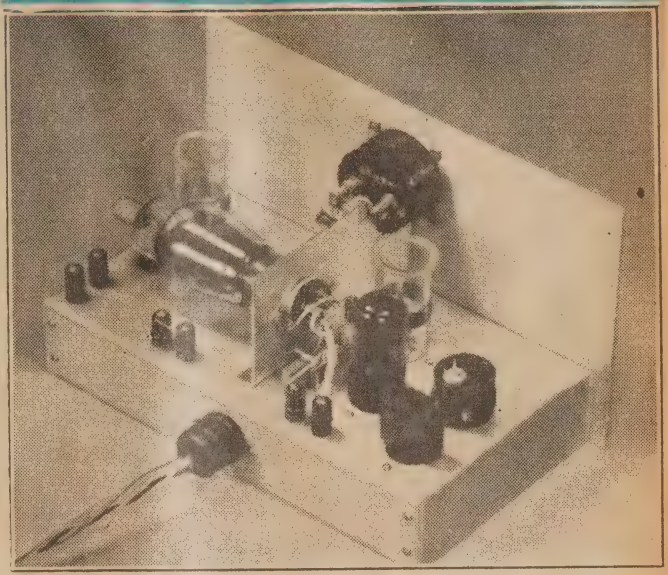
To make the meter read 100 milliamps full scale, as for the plate current of the 807, it is necessary to provide a shunt having 1/19th the resistance of the meter circuit. This works out at 5.3 ohms. For a 50 milliamp range, the shunt resistance must be 11.1 ohms.

WORKABLE VALUES

While neither value is standard, in a sense that it is available over the counter, something very close if not exact can normally be obtained from a distributor. Failing that, some odd low value resistor can be stripped down to give something very close to the desired value. Use can be made of an ordinary low resistance ohmmeter for such values whereas the same instrument would be useless if the resistor values were down to a fraction of an ohm.

The 11.1 ohm resistor is wired directly in the plate and screen supply of the 6V6-GT, while the 5.3 ohm resistor is connected in the plate circuit only of the 807. In the grid circuit, where the normal 5-milliamp range of the meter is adequate, no special shunt need be connected across the meter. Instead, the normal grid resistor connects to earth through a 1000 ohm resistor—a value which is too high to affect the meter reading to any extent, but not so high that it will alter the operation of the 807.

REAR VIEW OF THE TRANSMITTER



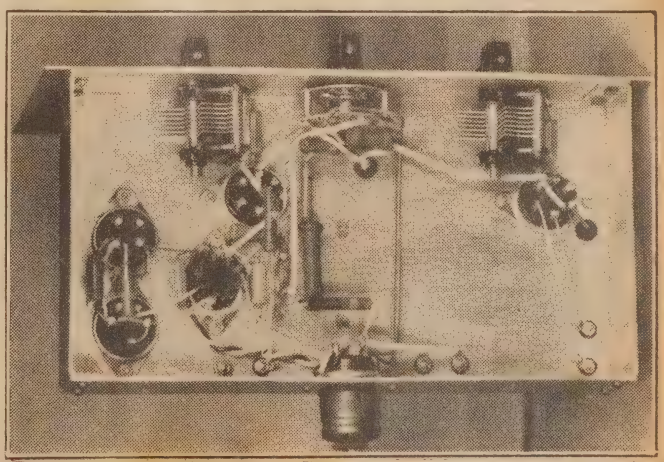
From the rear, the transmitter looks simple and clean. The partition which carries the 807 also forms a shield between the coils. Note the variable trimmer mounted inside the cathode coil.

To read current in these circuits, the meter is simply switched across the three resistors in turn, reading respectively 50, 5 and 100 milliamps full scale.

It is important to note that a five position switch is used for this purpose, two intermediate positions having no connections. If this precaution is not taken, the sliding contact will short between adjacent contacts in moving from one position to the next, with possible damage to the meter and to the circuits concerned.

The condenser connected across the meter serves to protect it against the possible effects of R.F. in the circuit.

There is not a great deal to the wiring, the main points being to see that all leads are kept short and rigid. A 5-pin socket is used for the crystal, pin 4 being used for one connection and pins 2 and 3 bridged across for the other. You will find that most crystals will plug into one or other of the alternative positions thus provided.



This underneath view of the chassis shows the extreme simplicity of the wiring. The output terminals are on the right, the modulator input terminals next, and the keying terminals on the left.

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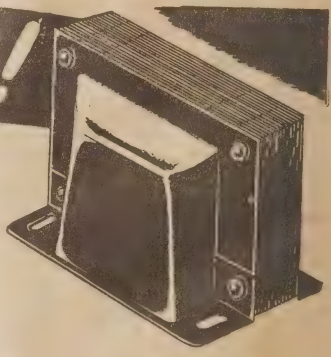

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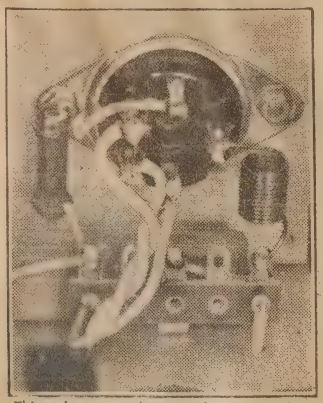

This close-up photograph shows the socket wiring of the 807. Note the grid choke, the 100 ohm screen suppressor and the bypass condensers returning to the common earth point.

The wiring of the cathode coil has already been explained, likewise the connections of the two plate coils. You will find that most of the resistors and condensers will mount directly between valve and coil sockets, although use is made of a 4-position tag strip, as seen in the underneath photograph. The resistors in the metering circuit mount conveniently across the switch points.

The grid circuit components of the 807 are mounted above the chassis, with another small tag strip helping to keep things rigid.

COMMON EARTH RETURN

It is wise to return the cathode and screen bypass condensers to a common earth point near the base of the shield. The 100 ohm carbon resistor in the screen circuit is a precaution against parasitic oscillation, as also is the small grid choke. This latter component consists of about 12 turns of 16-gauge enamelled wire, wound round a pencil.

Altogether, six terminals appear along the rear edge of the chassis. Two at the end, near the top cap of the 807, connect to the link in the plate coil and therefore connect to the aerial feed wires.

Two other terminals in a central position are in series with the B-plus line to the final plate and screen. For phone operation, the secondary of the modulation transformer would link in between them but, for C.W. operation, they would be shorted out.

The remaining two terminals are in the cathode circuit of the 807 and provide a connection for the key. They are simply shorted across for phone operation.

It will be noted that the circuit shows a separate B-plus connection for the tritet and final amplifier, and also separate filament leads. Separate filament windings are desirable for cathode keying since, in the key-up position, there is a large potential between the 807 cathode and earth. It is best to avoid risk of breakdown by tying the 807 heater to its cathode and operating the 6V6-GT from a separate winding.

A separate high tension supply is also desirable to the two stages for C.W. transmission. With a common power supply of ordinary design, the regulation is very poor and the variation in voltage on the tritet as the key is operated may be sufficient to produce bad "chirps."

Actually, the tritet needs only about 150 volts at 20-30 milliamps and this amount can, if necessary, be supplied from an old B-battery eliminator.

POWER SUPPLY

However, we are planning to describe in the next issue a composite power supply of rather novel design, which will ensure a well-regulated voltage on the tritet. The same chassis should have room for a power supply for a modulator, which will follow in due course as a third unit.

For phone only, the regulation of the power supply is not so important and the whole transmitter can be operated from any supply capable of delivering 400 odd volts at from 100 to 125 milliamps.

To put the transmitter into operation, plug in a 3.5 or 7.0 Mc. crystal and the appropriate coils, according to the table given earlier.

Set the meter switch to read 807 grid current, apply the high tension voltage and quickly tune the 6V6-GT plate circuit until a reading of grid current is obtained. Then switch the meter to read 807 plate current and quickly tune the plate circuit for maximum dip. You can check for operation under load by simply wiring a 15-watt globe between the plate cap of the 807 and one of the modulator input terminals. The lamp should light to full brilliance before the 807 is fully loaded up.

At this stage, it is wise to check on output frequency with the aid of an absorption wavemeter. While such an instrument will not show exact frequency, it does at least indicate positively that you have selected the correct harmonic.

CHECK COILS

Check the tuning of all coils which you propose to use and make any slight adjustments which may be necessary in the way of adding or removing a turn.

Now recheck the operation of the tritet under all conditions. Your 807 is intended to operate with about 3 milliamps of grid current but, in practice anything between about 2 and 4 milliamps can be tolerated.

If you find that the 807 grid current is running up around the 5 milliamp mark, increase the value of the 6V6-GT screen resistor until the grid current falls to the limits mentioned. Try to find a compromise condition where the grid current is satisfactory, whether the output frequency is on fundamental or on the second or fourth harmonic.

If adequate grid current cannot be obtained, your crystal may be in need of attention.

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FROM THE SERVICEMAN WHO TELLS

A job as a radio serviceman brings one into contact with all kinds of people and, as we have seen from recent correspondence, it has its funny side. However, a story was related to me during the month, ostensibly as "humorous," which I pass on to my younger readers as a word in season.

A CERTAIN lad (clever little chap) had built or acquired some equipment capable of putting a signal on the air. He had arranged with a school friend to listen on 2GB at a certain time.

"I listened, too," said my informant, "and sure enough there he was, practising his dots and dashes." I am afraid I do not see the point of the joke and did my best to have the offender warned about the serious nature of his action.

I do not know just what kind of gear the lad possessed but apparently it created a disturbing signal over a radius of many miles and would have interfered with the entertainment of many hundreds of listeners. Apart from the fact that such action is extremely selfish, it could have serious consequences. Dotted throughout the frequency spectrum are essential radio services operated by public utilities, aircraft and ship beacons, traffic channels and so on. It is by no means impossible that an unauthorised transmission could interfere with one of these services with serious results.

THE P.M.G. LISTENS !

But, in case such remarks are not heeded, it is well to know that the PMG Department in each state maintain a listening centre with operators who "police" the entire frequency spectrum and take immediate note of any illegal transmissions they might hear. Other smaller listening posts are maintained throughout the suburbs and in country areas as an adjunct to the main centre. When an illegal transmission is heard, it is possible to trace it to the source. The result is a court case, confiscation of the equipment and a fine of up to £500.

Strangely enough, despite all the warnings which have appeared in this and other magazines, there are still folk who are unaware that special conditions attach to the use of transmitting equipment. The technical editor tells me that a surprising number of people acquire disposals equipment and then get the bright idea of using it to talk to their friends a few streets away. As often as not, the factor which deters them is that they do not know what all the knobs and switches are for.

Sufficient to say no one can legally operate any transmitter, no matter how elementary, unless they have been given permission to do so by the PMG Department. Even then the equipment must conform to certain technical standards. Transmission must be made on the allotted frequency and must be limited in character to conform to the purpose for which the equipment was licensed. Broadly speaking, the only way that an experimenter can hope to operate a transmitter legally is to qualify for his AOCP and become a "ham."

I must admit that all this has not a great deal to do with radio servicing but the sheer impertinance of the offender and the way the story was related to me, rather "got me in." Anyhow, the chances are that the lad in question will read these paragraphs and be further warned.

RADIOGRAMS

I suppose we all have jobs to do at times which irk us and one which has that effect on me is tinkering with large gramo combinations which exhibit acoustic feed back. You may or may not know the effect, according to your experience with such sets.

Certain it is that every factory engineer knows all about it. The Sales Department calls for a big combination job and nominates a cabinet so wide by so high, and finished with such and such a veneer. It is fitted out with the largest chassis, a bigger and better speaker and such and such a pickup.

On radio it sounds fine, but, alas and alack, you can't turn it up to more than a whisper on pick-up without the whole box of tricks roaring its head off. It then becomes the engineer's job to make it play and keep it playing in production. I happen to know because I have toiled in factories where combination sets are made, and I've had to make them play!

In the light of this it is no wonder that home builders often find themselves in bother on the same count. The vicious part of it is that the more powerful a set is, and the better its bass response, the more likely is trouble to occur.

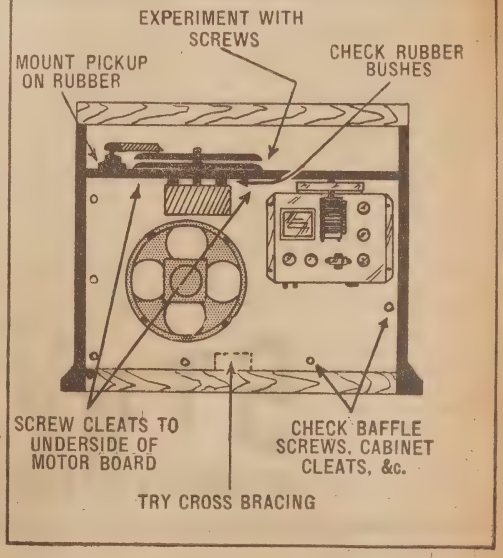
What happens, of course, is that the pickup sends an impulse through to the loudspeaker, which proceeds faithfully to reproduce it. In doing so, it vibrates the cabinet structure and the impulse gets back to the turntable and pickup. The pickup proceeds to produce a bigger and better impulse and the speaker faithfully does likewise. Within a second or so, the whole thing has the shakes. Because the cabinet cannot vibrate at a high frequency, the acoustic feedback is invariably a roar or rumble at about one hundred cps.

You can stop acoustic feedback in two ways—either by turning the volume down or by fiddling with the cabinet structure and mounting arrangements. The first method is completely effective, but suffers from the disadvantage that the pickup can no longer be heard. So you roll up your sleeves, move the cabinet out from the wall and start "fiddling."

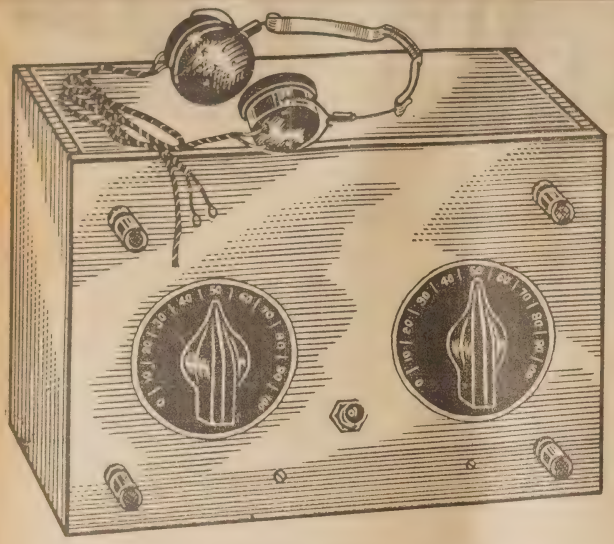
Leastwise, that's what I had to do once more during the month.

CABINET CHECK

The first step was to check over the cabinet generally, making sure that there was no obvious looseness to upset the original behavior. Open joints, loose braces, faulty cleats can allow sections of the cabinet to vibrate unnecessarily, and a coat of


EXPERIMENT WITH SCREWS
MOUNT PICKUP ON RUBBER
CHECK RUBBER BUSHES
SCREW CLEATS TO UNDERSIDE OF MOTOR BOARD
CHECK BAFFLE SCREWS, CABINET CLEATS, &c.
TRY CROSS BRACING

This sketch indicates points to be watched when checking for cabinet resonance.



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glue or a few extra screws may correct the fault. Unfortunately, it's seldom as easy as that.

More likely, obscure changes in the cabinet ply, ageing effects in the pickup and speaker, hardening of the motor suspension, all conspire to accentuate a tendency which is probably present in most gramo-combinations. Whereas the set when new might have given trouble only at excessive volume, it may ultimately exhibit acoustic feedback at ordinary room level.

Finding no obvious faults in the cabinet, I lifted the turntable and inspected the rubber grommets between the motor itself and the mounting plate. There certainly wasn't much cushioning effect left, and it was necessary to remove the bolts, turn the grommets over and generally "fiddle around" until the motor was slung more appropriately from its base plate. This improved matters considerably, and I explained to the owner, who was something of a handyman, that he should keep his eyes open for suitable rubber bushes, which could be substituted for the perished ones.

MOTOR PLATE

Next I lifted the motor plate clear of the base board and slipped an ordinary rubber grommet under each mounting screw. By varying the pressure on these screws while the pickup was playing, it was able to obtain a further reduction in the feedback.

In an extreme case one has to resort to all kinds of "dodges." Sometimes it helps to pack up the motor on rubber, mounting it quite loosely. Other times it is better to screw it down tightly, or to tighten some of the screws and leave the others a little slack. Anything to vary the mode or the period of the oscillation!

The pickup base mounting can also be checked. I have seen pick-ups mounted firmly and I have seen them almost floating on a pad of sponge rubber.

The motor board itself is an important item, since it is often made of thinner plywood and, therefore, given to vibration. Try screwing a heavy cleat across the under side.

Last, but not least, it may be necessary to cross-brace the cabinet inside or to vary the mounting arrangement of the baffle. I remember one line of commercial combinations which had the baffle board completely insulated from the cabinet by rubber mountings. Any wonder I don't like acoustic feedback? By the time one has been through the whole book of rules, the reaction is to suggest mounting the pickup or the speaker in a butter-box—it doesn't matter which—so long as they're separated.

READER'S LETTER

The letter I have chosen for this month comes from Mr. L. Kay, of Dudley Road, Charlestown. Mr. Kay says he has shared most of the experiences related to date in these columns, and gives details of a few of his own by way of a contribution. Says Mr. Kay:—

(Continued on Page 89)

HOW THE "WALES" WORKS — Branch Series No. 5

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FOR THE JUNIOR EXPERIMENTER

LET'S TALK ABOUT COMPONENTS—CONDENSERS

Tucked away beneath every radio chassis is a number of little components which we refer to as fixed condensers. They are so cheap and so commonplace that the average constructor never gives them a second thought, but, for the beginner, there are quite a few points about them which warrant explanation.

In schematic diagrams condensers are represented as shown in symbol (1). Just a couple of parallel strokes with a lead coming away from each one. Occasionally one of the strokes is elongated and bent around to enclose the smaller one, but this is the exception rather than the rule. Sometimes, too, you will note a condenser symbol with "plus" and "minus" signs, indicating an electrolytic condenser in which the method of connection is important. We will explain this presently, in greater detail.

For variable condensers, the symbol is generally as in (3), the curved line representing the rotor or moving plates. Alternatively, a variable condenser can be drawn as in (4), the arrow indicating variable capacitance.

The simplest possible condenser consists of two flat metal plates mounted side by side, but insulated one from the other. There is a certain capacitance between them, but no direct electrical connection. You will recollect that we have already discussed the property of capacitance in variable condensers and that it is normally expressed in microfarads, abbreviated to "uf." or "mfd." Very small values can be expressed in micromicrofarads (or picrofarads, which mean the same thing), and are abbreviated either to "mmfd." or "pf." 1,000,000 mmfd. or pf. is equal to 1 mfd. These figures will assume greater significance as we progress.

MULTIPLE PLATES

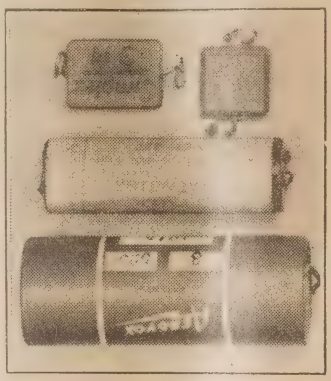
Only very low values of capacitance can be achieved by mounting two simple plates side by side. Capacitance is increased by making the plates larger, or putting them closer together, but there are obvious mechanical reasons why such a course of action is limited. If all condensers had to be built up this way, our radio sets would become as big as the whole house rather than just an item of furniture.

The insulated material between the plates is known as the "dielectric." It has an important bearing on the characteristics of the condenser and the substitution of insulating materials other than just air allow the same capacitance to be achieved in a much smaller space.

For example, sheet mica has a "dielectric constant" of about 5, which means that, all other things being equal, the substitution of sheet mica for an equivalent thickness of air increases the capacitance between two plates by a factor of 5.

This is actually the principle used in the familiar mica condensers. They are built up of alternate sheets of brass foil and mica, the whole assembly being held tightly together by a metal clamp or moulded in bakelite.

The alternate sheets of brass are bonded to form the respective "plates," as illustrated in our sketch.



Typical fixed condensers, mica and paper.

The simplest mica condensers have only two or three plates, while higher capacitance values are achieved by using a greater number of plates and/or increasing their area. The voltage which they are able to withstand without breakdown depends very largely on the quality and the thickness of the mica dielectric. If an excessive voltage is applied to any condenser, leakage and sparking will occur between the respective sets and plates, causing the condenser to break down and become useless.

Most mica condensers these days are moulded in bakelite with a tinned lug protruding from each end to facilitate connection into circuit. The capacitance ranges from about .00005 mfd. (50 pf.) up to about .01mfd. (10,000 pf.). In most cases the capacitance value is stamped directly on to the bakelite.

At this juncture, perhaps, it may be as well to mention that the capacitance of mica condensers is sometimes indicated by a color code similar to that used for resistors. We will probably explain the resistor code in detail in a later issue, but here are the figures for the condenser code for the purpose of reference.

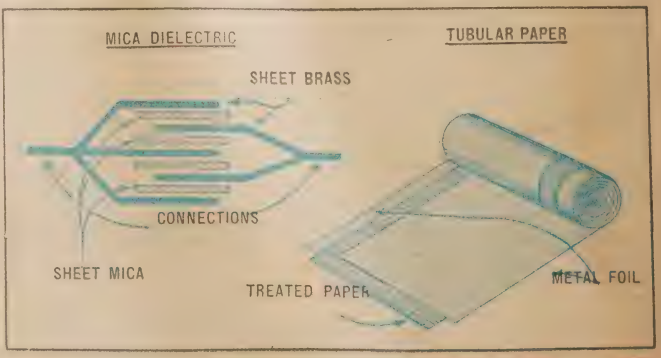
THE "DOT" SYSTEM

The first two dots from left to right indicate the first two significant figures of capacitance, expressed in mmfd. or (pf.). The third dot indicates the number of ciphers. Thus a .001 mfd. condenser (equal to 1000 pf.) has a brown dot for 1, a black dot for 0, and a red dot for the two additional ciphers. The dots should be read in a direction indicated by a pointer or arrowhead normally moulded around or alongside the color spots.

The significance of the colors are:

Black	0	Brown	1
Red	2	Orange	3
Yellow	4	Green	5
Blue	6	Violet	7
Grey	8	White	9

For values above about .01 mfd., mica condensers become rather bulky

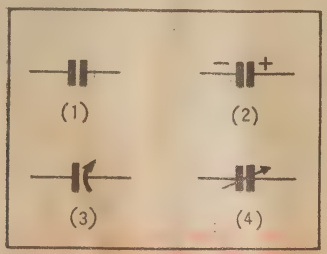


This diagram shows constructional differences between mica and paper condensers.

and expensive, and a completely different approach is adopted. Instead of using alternate layers of brass foil and mica, higher value condensers are generally made up from two long strips of aluminium foil, separated by a layer of specially treated paper, the whole lot being tightly rolled and sealed into a cardboard or bakelite tube.

We thus have what are commonly termed "paper" or "tubular" condensers, which range in value from about .01 mfd. to 0.5 mfd. They are generally provided with a tinned copper lead at each end for connection into circuit.

In addition to their capacitance rating, paper condensers generally carry a voltage rating expressed, for example, as "400V" or "400DCW." This indicates that the condenser can be expected to operate reliably with a dc voltage of up to 400 applied



The symbols for (1) fixed condenser (2) electrolytic condenser (3) variable
The symbols for (1) fixed condenser

across it. Voltages in excessive of this may cause breakdown.

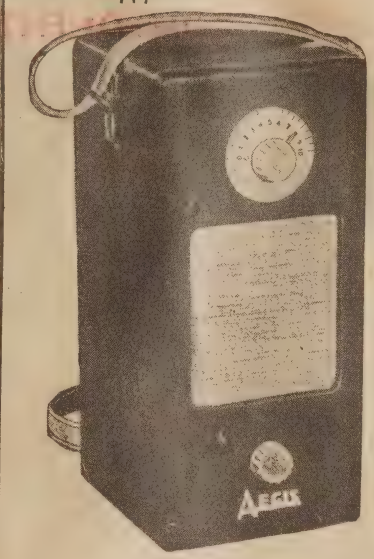
In recent years, manufacturers have released 200-volt tubular condensers which are physically smaller than the 400-volt type and, therefore, suitable for miniature sets or circuit applications where the applied voltage does not exceed 200. On the other hand, it is possible to buy 600 or 750-volt tubular condensers for applications requiring a greater margin of safety.

Ordinary mica condensers are seldom rated in terms of voltage, as most of them can be relied upon to withstand any voltage normally met with in a radio receiver.

For special applications both mica and paper condensers are available to operate in circuits involving several thousand volts but these are not likely to concern the beginner in radio. Apart from anything else, high voltage condensers are very bulky and very expensive.

As mentioned earlier, tubular paper condensers are commonly available in values up to about 0.5 mfd. For higher values of capacitance, assuming the same working voltage, paper condensers themselves become too bulky and too expensive for every day use. In fact, a couple of paper condensers of the capacitance required in a receiver power supply would take up more room than the power transformer itself. This difficulty has been overcome by the introduction of "electrolytic"

(Continued on Page 57)



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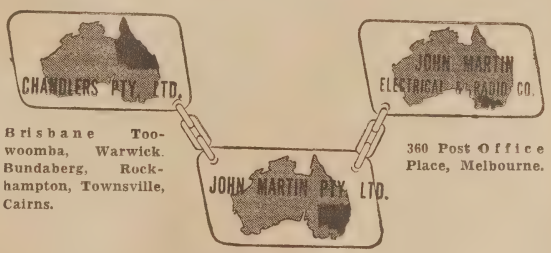

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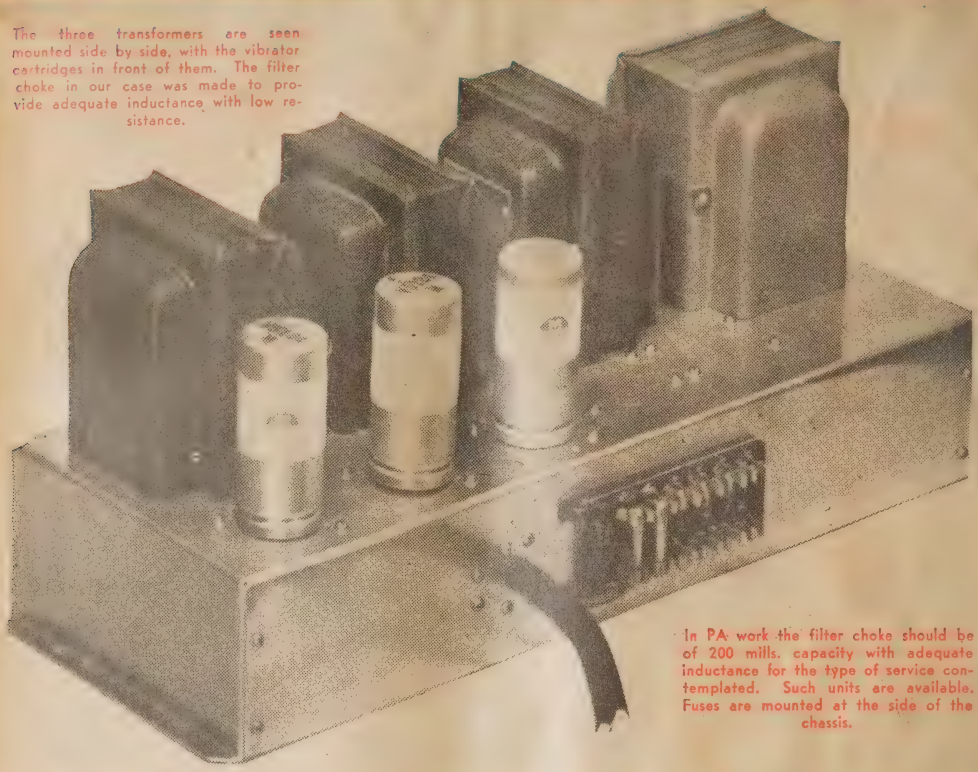


The three transformers are seen mounted side by side, with the vibrator cartridges in front of them. The filter choke in our case was made to provide adequate inductance with low resistance.

In PA work the filter choke should be of 200 mills. capacity with adequate inductance for the type of service contemplated. Such units are available. Fuses are mounted at the side of the chassis.

VIBRATOR SUPPLIES FOR P.A.

The following article examines the design of high wattage vibrator supplies and contains information of a type we have not previously seen published. It answers a variety of questions about vibrator ratings and performance and describes a practical 75-watt vibrator power supply. Suggestions are also made about methods of control.

OUR immediate interest in the subject was occasioned by experiments with a mobile radio system for our parent company—Associated Newspapers Pty. Ltd. A solution had to be found for a problem which faces every designer wishing to operate high power equipment from an auto electrical system—be it transmitter or P.A.

It is interesting to note at the outset the power requirements of a typical mobile radio system. The consensus of opinion, backed by our own experiments, indicates that it is desirable to provide for a power input to the final amplifier plate of from 25-30 watts. A still higher figure is a good thing, of course, for the best service, but it is necessary to bear in mind also the load imposed on the electrical system of the car.

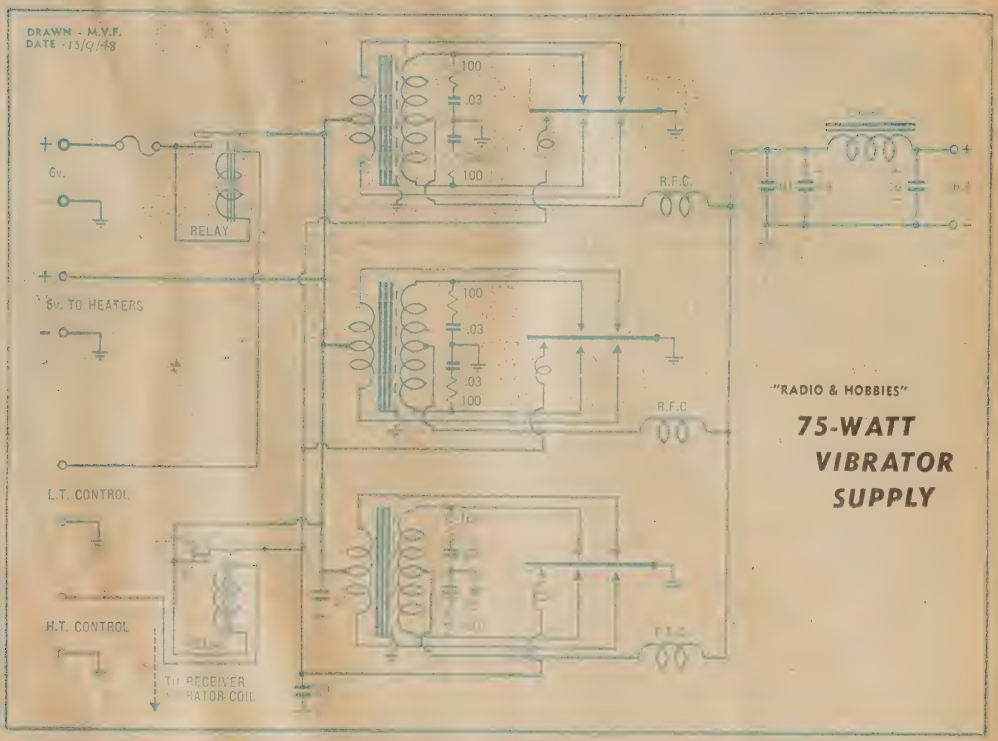
OUTPUT REQUIREMENT

Assuming conventional valves it is necessary to provide a full 300 volts to the final plate at a current of up to 100 milliamps. In addition, there is the screen current to consider, the crystal oscillator and a number of frequency multiplier stages. An A.M. transmitter will also include a modulator and, even assuming a low-drain Class B system, the total current drain is likely to amount to something over 200 milliamps, giving a total high tension requirement of 70 odd watts.

Allowing for a conversion efficiency of 66 per cent, the primary input requirement rises to 106 watts and the current at 6 volts to just under 18 amps. To this must be added several amps for the heater current of all valves in the receiver and transmitter, plus smaller amounts necessary to operate the switching and relay system. It is easy to see, therefore, that the total load current on the "transmit" position will approach 25 amps and, in fact, the most elaborate systems in use in America draw up to 50 amps at 6 volts in a particular instance.

In our initial experiments, use was made of a heavy duty supply, ex-disposals, but neither the original supply nor the large vibrator was available in numbers sufficient to operate a complete vehicular control network.

CIRCUIT OF A VERY HEAVY DUTY SUPPLY



Circuit details are discussed in the text. One, two, or three primary units may be used according to the drain desired from the supply.

The supply of genemotors was also investigated and, while all kinds of odd units are available from disposal sources, the supply of new 6-volt units giving the requisite output is a very different story.

There are other factors which make genemotors somewhat less attractive than a vibrator system. They are electrically less efficient, and present mechanical maintenance problems. Their inherent inertia militates against rapid send/receive procedure, while the associate switching has to break the full low tension current at each operation.

VIBRATORS

A vibrator supply, while it presents a greater problem with hash elimination, can be refined to such a degree that it becomes an almost entirely electronic device. It has no mechanical inertia and the send/receive switching can be arranged to make and break a current of only an amp or so.

Only conventional vibrator cartridges appear to be available in any quantity at the moment and our first job was to investigate the ratings and capabilities of these units.

In the normal way, small 6-volt vibrator cartridges are intended to operate with up to 3 amps input to the primary contacts — a matter of 18 watts. Allowing for ordinary conversion efficiency, the output from the transformer secondary under these conditions is adequate for the needs of any ordinary vibrator receiver.

At least one manufacturer conducts regular vibrator life tests, with four amps flowing to the primary contacts, and service under these conditions is completely satisfactory. Even 5 amps, representing a primary input of 30 watts, is a permissible overload. Beyond about 6 amps however, destructive arcing is likely to occur with possible overheating and welding of the contacts. Under these drastic overload conditions a great deal depends on the individual cartridge and the characteristics of transformer and buffer condensers.

All this refers only to the primary contacts, and it appears that very little increase in capacity can be expected if the primary and secondary contacts of an ordinary synchronous vibrator are connected together to give non-synchronous operation. In the normal way the primary contacts are adjusted to remain closed for a longer period than the secondary contacts. They still have to deal with the closing and opening current, which is the cause of most of the trouble.

NEXT month we hope to describe a vibrator supply which will allow vibrator operation of amplifiers designed for AC work, together with a discussion of further design features involved.

SPECIAL TYPE

If any real benefit is to be derived by connecting contacts in parallel, it is necessary to obtain from the manufacturers, a cartridge adjusted for this mode of operation. While this course would appear on the surface to double the input capabilities of a cartridge, manufacturers appear loth to give a rating on this basis.

The best that can be said, therefore, is that the use of properly synchronised and parallel contacts gives a substantial rise in the wattage capabilities of a vibrator.

Still another consideration is the choice of synchronous or non-synchronous operation. At first glance, it might appear that the task of the

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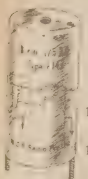

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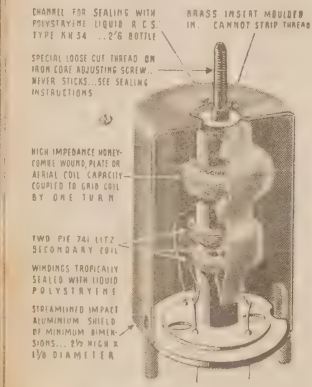
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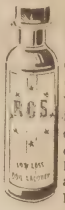

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H130 40m. Aerial 4 6

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1 P21 Padder.

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RF83 4 Pie 2.5 M/H R.F. Chokes 4 6

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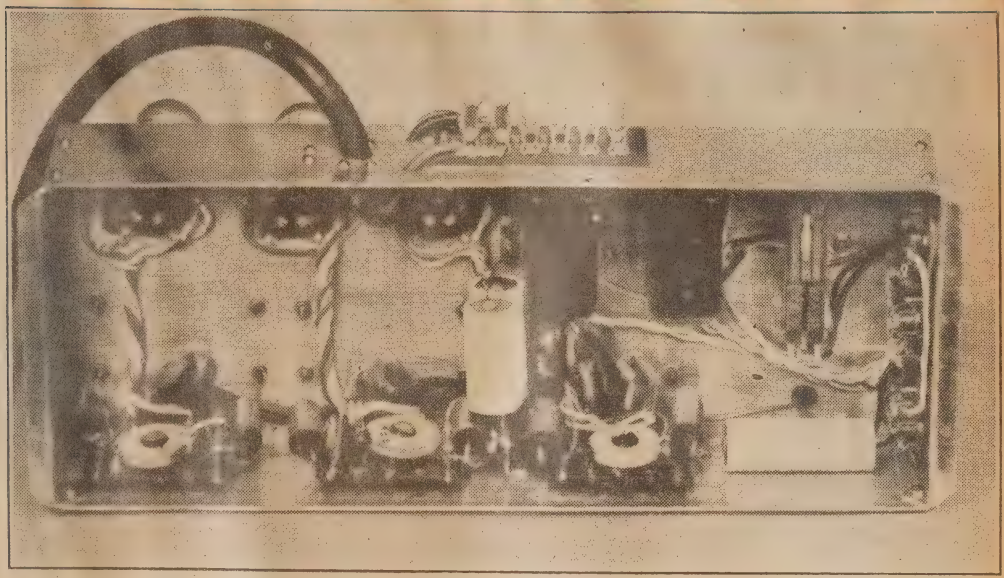
UNDER-CHASSIS VIEW OF HEAVY DUTY SUPPLY



This photo shows the three RF filters, one for each section.

vibrator would be made more easy if the job of rectification is passed over to a rectifier valve, but such is not necessarily the case.

With synchronous operation, the primary contacts open and close at an instant when the secondary load is disconnected and, assuming optimum buffer condensers, when there is only a very small potential difference across the contacts. When a separate valve rectifier is employed, the secondary load is present at all times, so that the primary contacts have to make and break an appreciable amount of current.

Valve rectifiers obviously require additional heater current, which amounts to 0.6 amp for the 6X5-GT, for every 75 milliamps of secondary output current. The impedance of a valve rectifier is also appreciably higher than the secondary contacts of a vibrator! Thus additional voltage drop occurs in the valve, which has to be made good in the primary circuit.

Since conversion efficiency and low "standby" current is of major importance in a mobile system, we finally decided in favor of a synchronous vibrator system for both transmitter and receiver.

MANY USES

It is appreciated, of course, that few readers may ever be called upon to work upon such a system, but the remarks apply equally well for amateurs whose equipment must draw its power initially from a home-lighting plant. Public address operators, too, occasionally must run their equipment from battery power.

Assuming that the high tension requirement approximates 75 watts, it is clearly impractical to obtain such a figure with a single vibrator except in the face of gross overload. The total load must, therefore, be shared between two or more vibrators by combining their outputs in series or parallel.

It is noteworthy in passing that two or more vibrators cannot be operated into the same transformer, even assuming the provision of separate primary windings. The secondary must be broadly resonant at the vibrator frequency and the whole circuit arranged so that the contacts will open and close at certain points in each cycle.

MULTIPLE CONNECTION

If two or more vibrators are coupled into the same magnetic circuit, it is inevitable that they will get out of step, to the obvious detriment of all components concerned. Any combination of output, therefore, must take place after rectification, where only d-c potentials are involved.

Manufacturers of commercial mobile equipment achieve the desired result in a variety of ways, some supplying respective sections of the equipment from individual supplies, while others combine the supplies to feed a common high-tension line.

Our own supply, shown in the accompanying photographs, combines the output from three transformer/vibrator combinations, each delivering approximately 340 volts at from 60 to 70 milliamps to a common filter. The individual vibrators, therefore, deliver about 22 watts from secondary and handle just over 30 watts in the primary contacts. The complete circuit diagram is shown.

It will be noted that each transformer/vibrator combination is complete in itself, the only wiring common to both being the d-c input and output. Each unit has its own buffer condensers and the rectified output is fed into a common 16 mfd electrolytic, followed by a large common choke and a second filter capacitance.

The ripple across the first electrolytic is not very high, the effect being that it receives charging pulses from three independent full-wave rectifiers instead of from a single rectifier in the normal case.

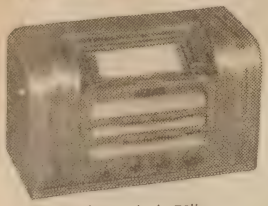
The choke should be designed to have adequate inductance with the lowest possible d-c resistance and the same remark applies, of course, to the windings of the modulation transformer. The choke, which is seen on one end of the chassis, is understandably larger than any of the individual transformers.

EXTRA FILTER

For some purposes, an additional filter section may be desirable, but this is a perfectly straightforward addition. Similarly, for decoupling circuits in the early stages of an amplifier or modulator.

The particular transformers were designed by a local manufacturer for this equipment, but are being made available on the market as a standard line. They require buffer con-

BREVILLE 5-VALVE DUAL WAVE RECEIVER



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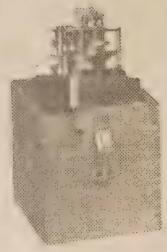

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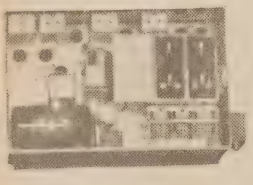

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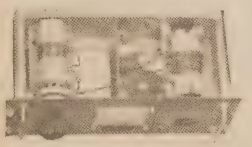

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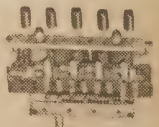

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densers of .015 mfd across the total secondary or twice that value across each half.

The condensers themselves presented a problem, indications being that high voltage mica types of the specified value would be very scarce and very expensive. However, it appears that standard 600 volt tubular condensers are capable of withstanding the peak voltage and these were duly installed. No breakdowns have occurred during the weeks which the equipment has been in service. We were fortunate enough to obtain .03 mfd condensers, but, if difficulty is experienced in obtaining the correct value, it may be necessary to connect individual .01 and .02 mfd condensers in parallel across each half of the windings.

It is most important that the buffer condensers be of the correct value, either as determined on an oscillograph test or by consultation with the transformer manufacturer. Too low a value will produce high transient voltages, while too large a value can increase the load on the vibrator and produce serious interference, due to an excessively steep wave-front.

BUFFER CONNECTION

The conventional procedure for series buffer condensers is to earth the junction, although there are occasions when interference is diminished by connecting the junction to B-plus.

Vibrator hash is not likely to be a problem in a transmitter, the only path of entry being into a low-level microphone circuit. For this reason only a small amount of RF filtering is provided in the unit, but it could be added if the supply is used with equipment more susceptible to hash trouble.

The control wiring and relay system deserves some comment, although the need for it will vary with each individual application. In our own case, the equipment had to be mounted in the "boot" of a sedan car and capable of complete control from the driver's seat.

The first requirement, therefore, was for relay switches capable of carrying the full current drain of the receiver and/or transmitter.

HEAVY RELAYS

After investigating various possibilities it was realised that ordinary motor-car cut-outs would serve the purpose, being cheap, plentiful and fitted, in most cases, with large-area contacts. The low resistance winding was stripped off completely and the high resistance winding unwound until enough wire was left to give a suitable balance between operating current and pressure on the contacts. Had it been necessary, it would have been a simple matter to run on a completely new winding of heavier gauge wire.

For the sake of convenience all switching and relays were centred in the transmitted power supply which therefore become the control unit of the installation.

Two auto type cut-outs will be seen beneath the chassis, one feeding the 6-volt supply to the transmitter and the other to the receiver.

One side of the magnet coil in each case is connected to the "hot" side of the 6-volt circuit, the other side being carried forward through separate leads to the car dash. A simple toggle switch returns each circuit to "earth," closing the cut-outs and making the six volts available as required to the receiver and transmitter.

Actually, the two switches can be connected in a series arrangement in such a way that the transmitter relay cannot be closed until the receiver is switched "on."

REED SWITCHING

A third relay of a different type picks up its current from the primary relays and directs the six volts as required to the driving reed in the receiver vibrator or the reeds of the transmitter vibrators. Our circuit does not show the full details of the receiver control, but it should not be difficult to install, if required for any particular application.

In our original installation, closing the two switches on the dash applies voltage to all heaters and also to the receiver vibrator reed via the third relay in its "at rest" position. Operating the "press to talk" switch on the microphone provides an earth return for the third relay coil, actuates the contacts and diverts the voltage from the receiver reed to the transmitter vibrator reeds.

A similar method of control can be applied very conveniently to a fixed amateur station operating from a home-lighting plant. A relay system of this type obviates the voltage drop in long leads and allows the power supply to be controlled conveniently from the operating table.

FOR P.A. WORK

A similar method of control is also invaluable in a large public address installation, particularly where the operator and microphone must normally be located at some distance from the equipment itself. A simple switch and a cut-out type relay will allow the heaters to be switched on or off during proceedings as required. A second simple "press to talk" switch will then apply current to the vibrator reeds and bring the amplifier into operation instantaneously. Such a system not only renders the microphone "dead" while announcements are not being made, but the saving in battery drain can amount to 70 or 80 per cent in some cases.

For mobile operation we had some doubts as to whether the vibrator reeds would maintain their normally central position despite vibration from a moving vehicle. Obviously, such mechanically-induced vibration, with the transformer circuit "alive," might be sufficient to pulse the transmitter. In practice, this effect has been found to be very slight and not serious enough to offset the advantage of being able to actuate the reed only by the send/receive switch.

The regulation of the vibrator supply is excellent, by the way, and completely adequate for the Class B modulator system.

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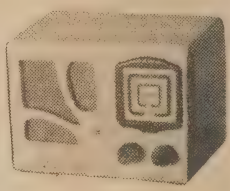

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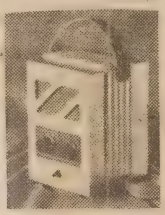

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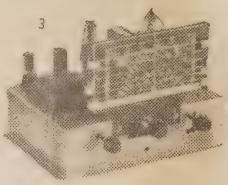

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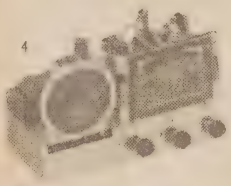

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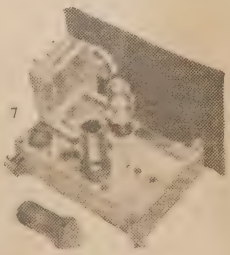

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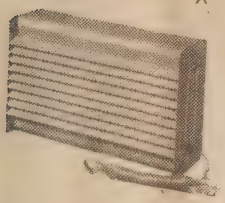

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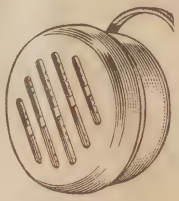

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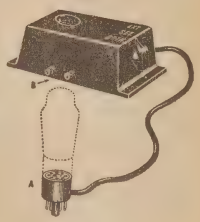

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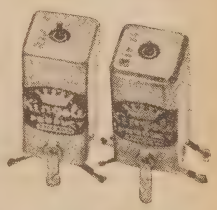

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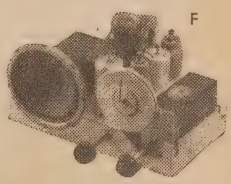

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TYPE	PRIMARY	SECONDARY	RATING
OP1	5000 and 2500 ohms S.E.	12.5, 8.0 & 2.3 ohms Voice Coil	10W
OP1A	5000 and 2500 ohms S.E.	500 ohm Line	10W
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OP3	6600 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W
OP4	10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W
OP5	5000, 6600, 10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W
OP6	5000 ohms P-P	500, 250 and 125 ohms	15W
OP7	6600 ohms P-P	500, 250 and 125 ohms	15W
OP8	10,000 ohms P-P	500, 250 and 125 ohms	15W
OP9	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	15W
OP10	5000 ohms P-P	500, 250 and 125 ohms	25W
OP11	6600 ohms P-P	500, 250 and 125 ohms	25W
OP12	10,000 ohms P-P	500, 250 and 125 ohms	25W
OP13	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	25W
OP14	5000 ohms P-P.	500, 250 and 125 ohms	32W
OP15	6600 ohms P-P	500, 250 and 125 ohms	32W
OP16	10,000 ohms P-P	500, 250 and 125 ohms	32W
OP17	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	32W

TYPE	PRIMARY	SECONDARY	RATING
OP18	3300 ohms P-P	500, 250 and 125 ohms	60W
OP19A	5000 ohms P-P (30-10,000 C/s)	12.5, 8.0, 2.3 ohms Voice Coil	15W
OP19B	5000 ohms P-P (30-10,000 C/s)	500, 250 and 125 ohms	15W
OP20	11,600, 8400 ohms P-P (P.A. Range)	500, 250, 166 & 125 ohms	150W
OP21	8000 ohms P-P (30-15,000 C/s)	500/125 ohms	15W
OP22	3250 ohms S.E. 85 M.A. (30-15,000 C/s)	2.3 or 500/125 ohms	10W
OP23	3250 ohms S.E. 85 M.A. (30-15,000 C/s)	12.5 or 8.4/2.1 ohms	10W
OP25	10,000 ohms P-P (20-30,000 C/s)	Any Two Impedances in 4 to 1 ratio e.g. OP25 500/125. OP25 8.4/2.1 OP25 10/2.5	15W
OP8M	10,000 ohms P-P	500 ohm Line 10 Tappings	15W
OP15M	6600 ohms P-P	500 ohm Line 10 Tappings	32W
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U1	30,000, 20,000, 14,000 10,000, 7000, 5000	2.3 ohms Voice Coil	10W
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1P2	Single 6V66 Triode 40 M.A. D.C. Unbalance	Class AB2 P.P. Grids 807, etc.	2.5	1P4 S.E. or P.P. Triodes	Class B P.P. Grids 809, B30B, etc. 2.8 or 2.15

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M25	6000 & 8000 ohms P-P	10,000, 7000, 5000 ohms, 100 M.H.	25W	M50M Multi Primary	Multi Secondary 50W
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CONDENSERS

(Continued from Page 47)

condensers. Of these there are two main types—"wet" and "semi-dry."

Electrolytic condensers are not so reliable or permanent in their characteristics as paper condensers, but their small size and low cost makes them a proposition, despite this.

It is most important always to watch the polarity of electrolytic condensers since, unlike the other types they can be connected only one way in a circuit. In wet electrolytics, which are not very common now days, the can is always negative, while the centre connection is positive. In tubular types the positive end is either marked "positive" or indicated by a spot, band or disc of red.

When used in a filter circuit, electrolytics must always be connected with the positive end to B-plus and the negative side to chassis or B-minus, as the case may be. In cathode circuits the negative end goes to chassis while the positive end goes to cathode. In back bias circuits, the positive end goes to chassis and the negative to the bias point.

Electrolytics intended for high tension filtering most commonly are made in capacitance values of 4, 8 and 16 mfd and a peak voltage rating of 525. This rating is relatively critical and, if the peak voltages rise appreciably above it, the dielectric is likely to puncture and render the condenser a short circuit. Where a margin of safety is required, it is possible to buy 600-volt electrolytics but this is the maximum voltage rating which can be achieved with ordinary materials.

LOW VOLTAGE ELECTROS

Cheaper and smaller electrolytics intended for use with cathode circuits are commonly made to a capacitance of 10 and 25 mfd, with a peak voltage rating of 40. Then there are other condensers intended primarily for vibrator receivers with a capacitance value of 500 or 1000 mfd, and a peak voltage rating of from 6 to 12. We can only leave to your imagination the size of a paper condenser which would be necessary to achieve this capacitance. As it is, a 1000 mfd electrolytic condenser is contained in a can only about 3ins. in length and less than 1in. in diameter.

As previously mentioned, paper and mica condensers are not critical in regard to polarity like the electrolytic type. However, tubular paper condensers are often marked with the words "outside foil—connect to earth." As the sentence implies, the particular end connects to the foil which happens to form the outer wrapping of the assembly. In circuits requiring one side of the condenser to be earthed, earthing this end shields the condenser as a whole. In critical cases some contribution is thus made to stability, although in practice it is a minor point.

So much then for fixed condensers. Next month, we guess, it will be resistors of one type and another.

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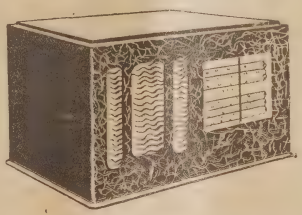

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Getting Started On F.M.

Last month we outlined briefly the nature of an F.M. signal and the design features of a typical F.M. receiver. Now we really come to grips with the subject as we set out to examine in detail the design of each individual section. We may as well tackle the hard part first —the F.M. detector.

OTHER sections of an FM receiver differ considerably from the broadcaster AM counterpart; but the differences, as much as anything, are the result of the higher signal frequencies. Those who have had experience with receivers for 50 megacycles and over will already appreciate the need for proper selection of valve types, care with layout, and so on.

The most urgent need, for most enthusiasts, is to acquire a clear mental picture of how an FM detector can convert changes in carrier frequency to audio impulses. Detailed study of other sections of the receiver can follow at a later date.

MODULATION

Part of the complication surrounding an FM detector arises from the fact that the change in a frequency-modulated carrier is much less positive, in effect, than in an AM carrier. In the latter case, full modulation varies the amplitude from zero to twice its static value—a variation of plus and minus 100 per cent. In the case of an FM carrier, the amplitude is constant and full modulation represents a change in frequency of less than 0.1 per cent. Even referred to the intermediate frequency of a receiver, the deviation is still less than 1.0 per cent.

From this comparatively small percentage deviation, the FM detector has to derive a substantial audio signal, and it is little wonder that its design and adjustment are rather critical.

An FM detector has to exhibit a curve similar to figure 1, which shows audio output voltage plotted against deviation of signal input frequency.

The straight portion of the curve must be sufficiently wide to include the maximum frequency deviation which, in the normal way, will be plus and minus 75 kc. If its characteristic is not linear over this full range, the detector will introduce harmonic distortion in the output.

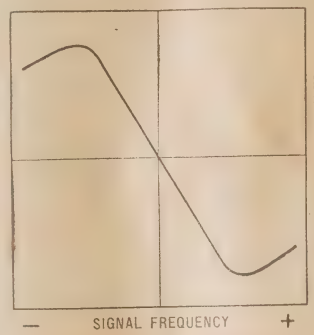

Fig. 1. Curve for FM detector.

The slope of the curve should also be as steep as practicable, indicating a high audio signal voltage for a given deviation in carrier frequency.

A complete FM detector circuit can really be divided into two parts, namely, the detector valve itself and the IF transformer which feeds it. The detector valve is generally a twin diode, but the transformer is a specially designed unit, which is particularly responsive to variations in carrier frequency. As we shall see, the key word in considering the operation of this transformer is our old friend (or enemy) "phase."

Consider an IF transformer, as in figure 2a, with a tuned primary and a tuned secondary, the latter winding being centre tapped. Signal currents passing through the primary induce voltages in each half of the secondary, which are equal, but 180 degrees out of phase. The voltages remain equal, whether or not the signal frequency happens to correspond with that to which the transformer is tuned. It is, therefore, of no immediate assistance in dealing with a frequency modulated carrier.

UNBALANCE

What is obviously required is some treatment of the transformer which will introduce a condition of unbalance between the two halves of the secondary when the signal frequency deviates to either side of resonance.

Having obtained this dependence on signal frequency for balance or unbalance, it then becomes a relatively simple matter to extract the audio component.

Exactly the effect we want can be achieved by connecting a condenser between the "hot" side of the primary winding and the centre tap of the secondary.

Two effects are now present. A

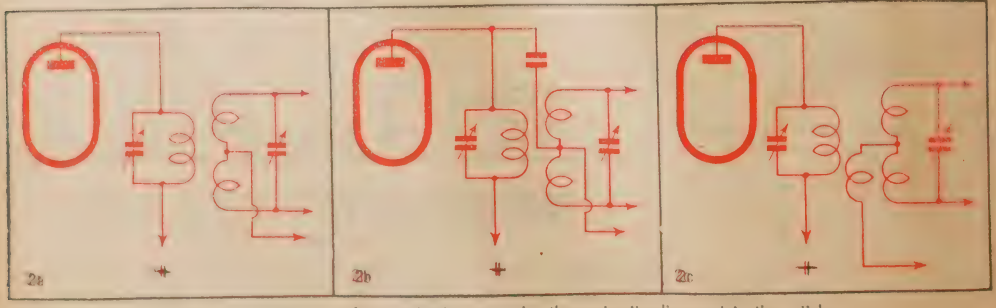

Fig. 2. Showing transformer circuits using the three circuits discussed in the article.

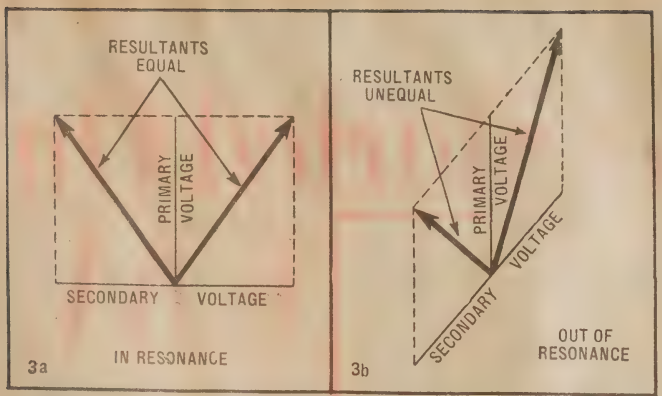

Fig. 3. Vector diagram showing how phase relationships operate in the FM detector.

signal through the primary winding will induce out-of-phase voltages in each half of the secondary, exactly as before. In addition, the entire secondary winding, including the outer ends, acquires an RF potential, since it is coupled by a condenser to the preceding amplifier plate.

The signal voltage at each end of the winding therefore becomes the resultant or combination of the energy imparted to it by the magnetic and the capacitive coupling. This is where phase enters the picture in no uncertain fashion.

When the signal frequency is in resonance with the transformer, the voltages cross each half of the secondary, due to magnetic coupling, and are exactly equal and exactly 90 degrees out of phase with the primary voltage. These are combined with the direct primary voltage, introduced by the condenser coupling, to produce resultant voltages at the transformer ends which have a phase difference but are exactly equal in amplitude.

If you can follow a vector diagram, the condition at resonance is indicated by figure 3a.

RESULTANTS CHANGE

When the signal deviates from resonance, the voltage applied to the secondary by the coupling condenser remains substantially the same, but the voltage induced by the magnetic coupling shifts appreciably from its orginal 90 degree displacement. At the outer ends of the winding the resultant voltages are no longer equal, the different phase relationship tending to add in one case and cancel in the other.

Referred once again to a vector diagram, we have the resultant shown in figure 3b—an off-resonance signal and unequal voltages at the outer ends of the transformer secondary, with an FM carrier the signal swings to and fro at an audio rate and differing voltages appear sympathetically at the outer ends of the transformer secondary. The job is half done!

If you have not followed each step of the foregoing discussion go back over it, for your understanding of an FM detector will depend almost entirely on grasping these fundamental phase relationships.

One more point must be made before we pass on. The desired result was achieved by providing normal coupling between the two tuned windings PLUS capacitive coupling to the centre point of the secondary. Much the same result can be obtained by returning the mid point of the secondary to a tertiary winding tightly coupled to the primary.

This method is considered by some to be more convenient electrically and, in fact, you will note it in many current FM circuits. But the result is the same: A balanced signal at each end of the secondary with the signal in resonance, and a condition of unbalance as the signal deviates in frequency either up or down.

The second section of the detector circuit simply translates the varying condition of balance into audio impulses similar to those which originally caused the frequency swing.

The circuit which came in for the greatest initial attention is known as the Foster-Seeley discriminator —a high sounding term which can be paraphrased as an FM detector developed by one Foster and one Seeley.

This discriminator — or detector— is very sensitive to variations in signal frequency, but it also responds to variations in carrier amplitude. This is a disadvantage because half the story behind FM is the ability of the system to reject background noise, which is largely an amplitude variation.

For this reason, a Foster-Seeley discriminator is normally preceded by one or two "limiter" stages, whose job it is to reject amplitude variations. Since the two functions are more or less inter-dependent, it is better that we leave discussion of the Foster-Seeley circuit and its associated limiters to a future and separate article.

Our immediate interest centres on the so-called "ratio" detector, which is responsibe to variations in signal frequency but not to amplitude. It can be regarded, therefore, more truly as an FM detector, although there are points in favor of both circuits.

So for the ratio detector, which is shown in its bare essentials in figure 4.

SERIES DIODES

The outer ends of the IF transformer secondary are connected to a pair of diode elements, to cathode in the one instance and to plate in the other. The two remaining elements are connected in series with a common load resistor R2, bypassed by a condenser C2. For convenience, the lower cathode is grounded to chassis.

The tuned secondary is inductively coupled to the primary and a tertiary coil is connected between the centre-tap of the secondary and earth, via a second load resistor and bypass, R1 and C1.

In the presence of a signal, the two series diodes conduct and build up a voltage across R2 and C2, in familiar fashion. In practice, C2 is made very large, giving a long time constant to the combination. Thus the potential across R2 and C2 assumes a certain value for each in-

(Continued on Page 96)

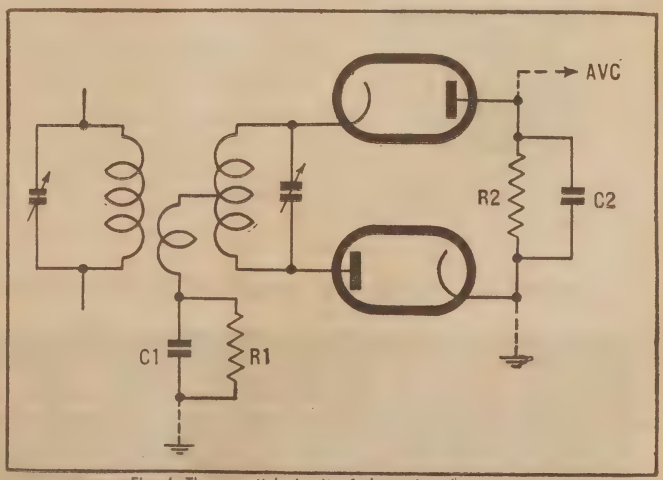

Fig. 4. The essential circuit of the ratio detector.

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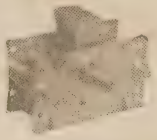

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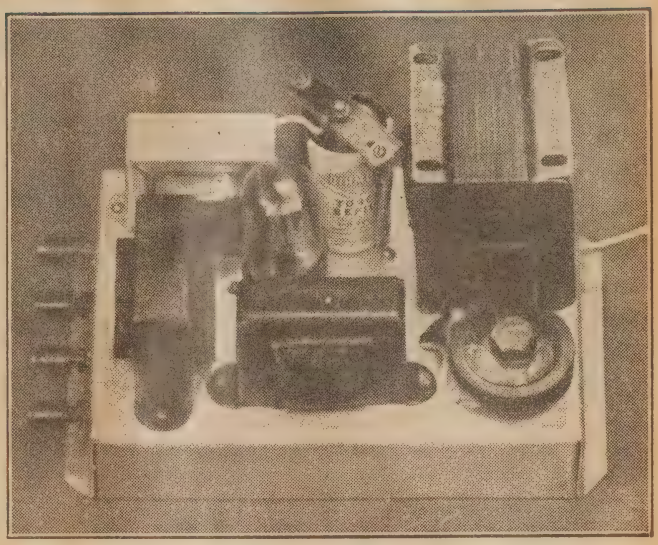
These were the very facts which led us to the design of the "Multie-Talkie," featured in the July issue. It is a fairly safe bet that it will set the style for the new season's portables.

In designing the "Multie-Talkie," you will remember that we went to a lot of trouble to connect the filaments in series for power mains operation, and we explained the reasons for so doing. Despite our remarks in that issue, the article prompted a stream of letters from readers who already possessed a miniature portable and wanted some of the flexibility which the new design offered.

The rectifier unit is at the bottom right hand side of the chassis. Note the battery held in place by a simply made spring clip.



This power unit makes it possible to operate any midget portable from the a-c power mains. It provides an independent supply for the filament and high tension and therefore does not interfere with back-bias arrangements in the receiver.

It is obviously impracticable to alter all existing receivers to the "Multi-Talkie" circuit, so there was no alternative but to investigate the possibilities of a unit which would simply replace the batteries. In other words, we needed 1.4 volts at approximately 0.25 amp. and 67 volts at 10 odd milliamps.

There is no difficulty at all about the high tension supply, the only requirements being a small power transformer, rectifier, and the components for a simple filter. The filament circuit presents the real problem.

It is not practical to operate the valve filaments from a-c, since it would be equivalent to injecting a 1.5-volt 50-cycle signal into each grid circuit. The result we leave to your imagination.

Even if this objection were overcome in part by accurately centre-tapping the filament circuit, the fine filaments would still vary in temperature, in sympathy with the alternating voltage, producing a very severe hum. Apart from this, of course, it would not be practical to uproot the filament circuit of existing sets. To be of any use, the unit must simply replace the batteries and require no changes at all in the receiver.

Mere rectification of the filament supply voltage does not solve the problem, since the heating cycles are exactly the same as for a-c, and some form of filtering is essential to smooth the ripple from the rectified a-c. It is not nearly so simple as it sounds.

A typical personal portable draws 0.25 amp. at 1.5 volts, which represents a resistance of only 6 ohms. The ripple frequency is 100 c/s, and, to be of any use, the condenser reactance must be low and the choke reactance high compared with the 6 ohm load. At the same time, the choke must be capable of carrying 0.25 amp. and present very low d-c resistance.

To quote typical figures, the largest filter condenser commonly available is a 500 mfd. electrolytic, and this has a reactance at 100 c/s, of about 3.2 ohms—not an entirely encouraging picture. A typical commercial filament choke has an inductance at 0.25 amp. of about 200 mH, which represents a series reactance of just over 60 ohms. Very obviously, the filter components available are not of such an order that they can be expected to deal summarily with the ripple content.

In practice, this needs to be very low indeed, if hum is to be avoided, both from variation in filament temperature and by direct injection into the heater circuit.

After all this, you may be just about convinced that the whole idea of a rectified filament supply is impractical, but there is more to come.

The only cheap rectifier available for the job is a simple full-wave unit requiring normally a centre-tapped supply winding. Thus a special filament transformer seems inevitable, as well as the standard transformer for the high tension supply.

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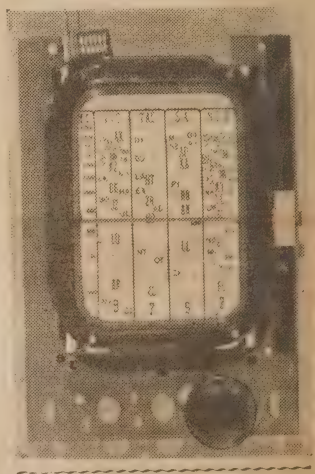
Escutcheon opening 3½" x 2½"

Scale glass in two colours

Condenser Calibration H. & A.W.A.

Suitable for "All Battery Five" as illustrated in September issue of Radio & Hobbies.



EFCO RADIOMASTER DIALS

The EFCO
MANUFACTURING CO. PTY. LTD., ARNCLIFFE, N.S.W.

supply could not be relied upon so that we were frankly puzzled to know just how readers would get on who had no meters to adjust the voltage for their particular set. Furthermore, if one filament should fail, for natural reasons, the remaining filaments would receive an increased voltage, the effect being accumulative as the load current was progressively reduced.

In spite of all this, our circuit is entirely practical and foolproof.

Assuming that all the power was to come from a single "Minivox" type transformer, we had to use the normal 6.3 volt winding, which has no centre tap brought out. An electrical centre tap was established by connecting two 5-ohm 5-watt resistors across the winding. They impose a load of 0.6 amp on the winding and dissipate 2 watts each in so doing. Lower values would load the winding unduly, while higher values would allow too much drop in the dc output from the system.

The winding is interconnected to the rectifier as shown, and the output taken to the first filter condenser. You may be fortunate enough to purchase 1000 mfd electrolytics, but 500 mfd is the only type normally available. Connect two in parallel for preference, although the supply will operate with a single 500 mfd, in each section of the filter.

Two iron-cored low tension chokes are required and those in the original supply were normal types having an inductance under load of approximately 0.2 henry. A much higher inductance is to be desired but the resulting choke would be a very expensive proposition.

As it is, a 2-section filter involving two conventional chokes and three condensers does not give anything like enough filtering and we, therefore, adopted the only possible way out of the difficulty—and a rather unconventional one. The final filter condenser is replaced by a simple 1.5 volt torch cell, which clips on to the chassis with a strip of bakelite and couple of springs.

A torch cell has a very low internal impedance and, at its operating potential, provides the same degree of filtering as a very large condenser. Furthermore, it provides regulation of the filament supply voltage, so that it does not rise appreciably above 1.5 volts, even with no load at all on the rectifier. Here then is the solution to both the filtering and regulation problem.

The unit is designed basically so that it will provide 1.5 volts to the filaments under the anticipated load of 0.25 amp. and the torch cell is simply connected across it. It then ceases to be a matter of concern whether the load current is 0.2 or 0.3 amp. or whether the mains voltage fluctuates by an unspecified amount.

The torch cell itself should have a very long life, although of course, we have not had the opportunity to run actual service tests to demonstrate its life. It more or less floats across the supply and should need replacement only at rare intervals. If the hum level begins to increase, or the filament voltage to rise, it is time to spend ninepence on another "filter" battery.

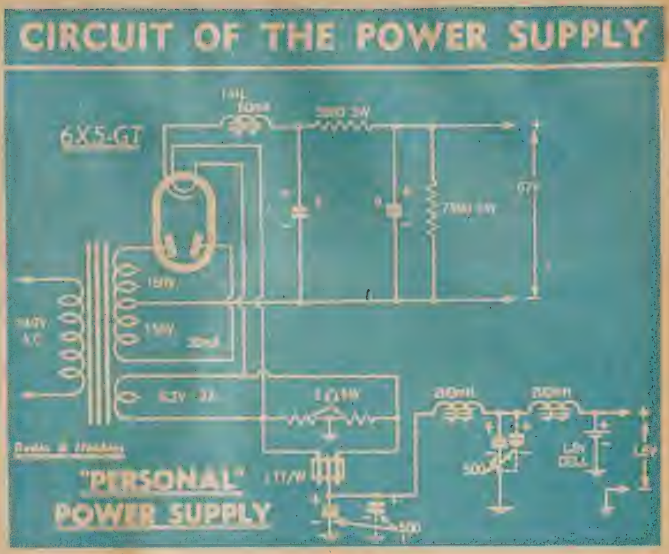
We admit that the scheme is rather unusual in this application but the idea of a floating battery bank for filtering, regulation and emergency operation is widely employed in communication circuits. At any rate, it solves this problem rather neatly.

Actually the filament supply is not completely free from ripple but it is sufficiently free to operate a miniature portable. The small speakers and cabinets give very little response at 100 c/s and the output is, therefore, substantially free from hum. The same remark does not apply for receivers using a large speaker, especially if the cone resonance happens to be close to 100 c/s. The unit will still operate the set quite well but with a noticeable hum level.

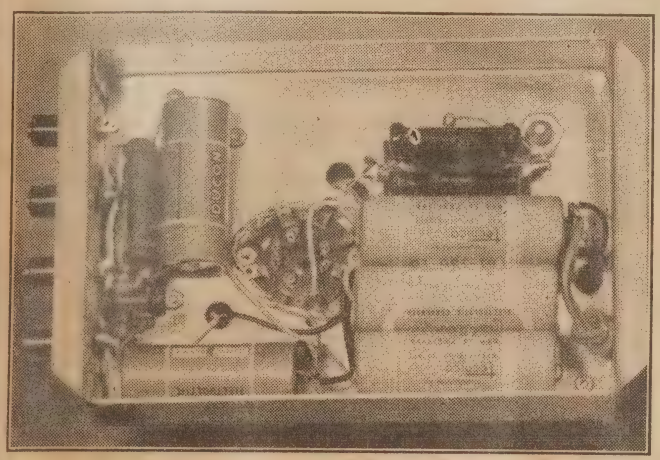
Only extreme measures can eliminate the hum completely from a filament supply of this type. During our investigations we heard from an engineer who had ended up with three chokes and a total of 24,000 mfd in a 2-volt supply—and there was still a trace of hum in the output!

But these are merely words of explanation. In the normal way you will not be troubled with hum when operating a personal portable.

The high tension supply is quite a conventional arrangement and calls for little comment. The heater of the 6X5-GT rectifier operates from the same 6.3 volt winding as the metal rectifier, but the separate cathode gives complete isolation of the "A" and "B" supplies.



The circuit is simple—its main feature is heavy filtering.



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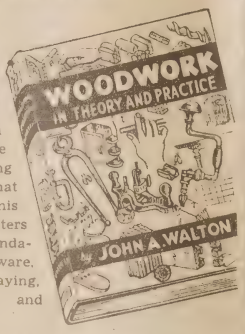

Although primarily intended for students attending technical and secondary schools, "Woodwork in Theory and Practice" will prove of equal value for the man who has had no training in wood-working, but feels that urge to make things with his hands. The various chapters deal with tools, processes, fundamental constructions, hardware, timbers, wood turning, inlaying, veneering, wood polishing and projects.

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(Tech. R.H. 10/48)

It is important to note that "B-minus," represented by the transformer CT, is not earthed, but is brought out to a terminal for connection to the receiver. This safeguards any back-bias circuit which the receiver may utilise.

The high tension filter involves an 8 mfd. input filter condenser, a small filter choke, a couple of resistors and a final 8 mfd. filter. The two resistors are proportioned to give about 67 volts at from 10 to 12 milliamps drain. The exact voltage will vary, of course, with individual receivers and component combinations, but not enough to endanger

> DON'T forget to switch your portable "off" in the normal way as well as at the power-point. Otherwise the filaments will remain on and will discharge the torch cell.

the well-being of the valves. If you have a voltmeter on hand, or have any special voltage requirements, it is a simple matter to vary the proportion of the two resistors to give a slightly different output.

Broadly speaking, it is not wise to operate any receiver with more high tension voltage than originally intended, since it may draw excessive current under these conditions. Bias and supply resistors, determined on the assumption of 67 plate volts, may be quite unsuitable for 90-volt operation.

From the mechanical viewpoint the layout is best arranged to suit individual requirements. There is nothing critical about it, the main point being to see that suitable connection is provided for the 1.5 volt cell. It can be clipped into place with a couple of springs and a bakelite strip, or soldered directly into circuit. As previously mentioned, occasional replacements will be necessary.

THE CHASSIS

Our own supply was built on a little aluminium chassis measuring 7in. x 5in. x 1½in., with a flange at each end. The components fit in quite neatly and four terminals at the end provide the output connection. "A-minus" is common to the chassis and will normally be joined also to the receiver chassis.

The method of connection to the receiver circuits will vary with each individual type of set. In the normal way, the high tension leads can terminate in a home-made fitting, which will clip on to the glove-like fasteners normally provided for "Minimax" batteries. The filament lead termination will have to match whatever arrangement has been provided in the receiver for connection to the torch cell. If you want extra protection for the filaments, wire a resistor of between 0.25 and 0.5 ohm in series with the A-plus lead to the set, which will keep the voltage at all times down to under 1.4.

However, these are minor details which the average enthusiast should be able to look after himself. Our main concern has been to investigate and solve the electrical problems of the circuit.

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Your Radio Hobby Needs AT BARGAIN PRICES

Radiogram Cabinets, as illustrated. Walnut Piano Finish Standard Model, £13/19/6. Model with deep well to suit Record Changer. £14/7/-.

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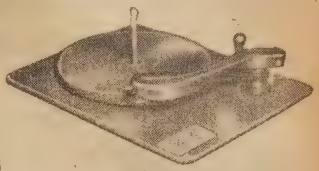

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Build your own Cathode Ray Oscillograph, with the famous 5BPI 5" Cathode Ray Tube. Originally cost £15/0/0. Now only 37/6, plus S. tax.

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A CRYSTAL SET THAT REALLY WORKS! The Capitol De Luxe Crystal Set. Scientifically designed as illustrated. Complete with English Headphones. £3/17/6.

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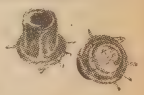

Type EF50, 16/-; Type EA50, 16/-; Type 954, 16/-; Type 955, 16/-; Type 7A6, 16/-; Type 807, 16/6; Type 42, 14/-; Type 7C7, 17/3; Type 2X2, 16/6; Type 834, 30/3; Type 6SH7, 16/-; Type 211, 28/3; Type 830B, 25/-.

Telephones, Army Disposal with up to 10 mile range. Ideal for Extension Inter-Communication without rental. As illustrated. 2 Gns.

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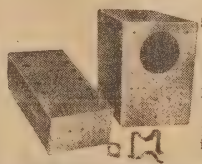
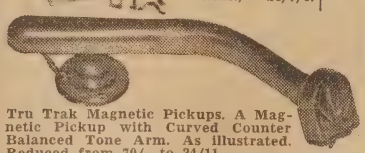


5" Cathode Ray Oscillograph Cabinets.

Black Crackle Finish Steel Drilled Cabinet and Chassis. Complete with Brackets, as illus., £4/7/6.



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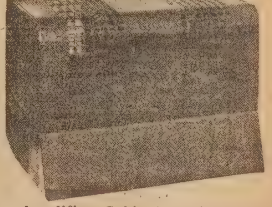

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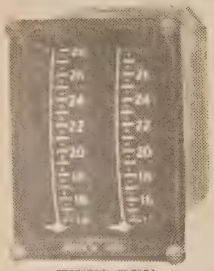

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BOOKS, BOOKS, BOOKS: Ultra High Frequency techniques by Brainerd, 22/6; Through the Overcast by Joodanoff, 7/6; Wireless Direction Finding by Kein, 6/6; Air Strategy by Macmillan, 1/6; Inman's Nautical Tables, 9/6; Your Wings by Joodanoff, 7/6; Flight by Wright, 6/-; Win Your Wings by Turner, 2 vols £1.

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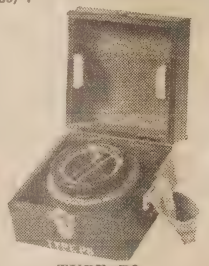

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17/6 per 100 yard reel.

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6" Permag £1
8 mfd. 350V. W., 2/9 each.

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12v. 42 amp., £10/10/-.

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Per 20yd. coil.

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No technical knowledge required to install. Used same as P.M.G. phones.

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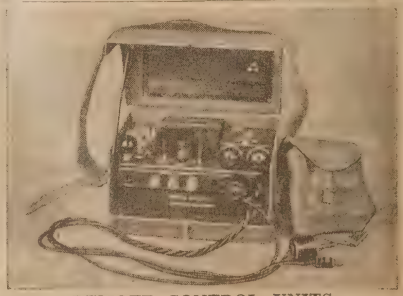

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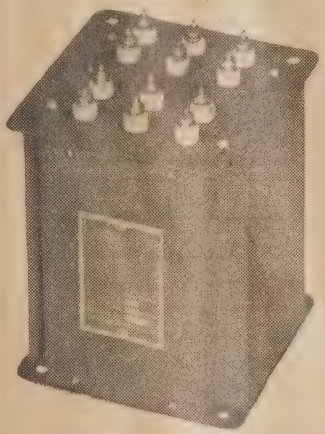
When ordering by Mail Order please give nearest railway station, postal address and State.

TRADE REVIEWS AND RELEASES

FERGUSON 125-WATT MODULATION TRANSFORMER

Most recent addition to the range of Ferguson audio equipment is this 125-watt modulation transformer. Designated as type M-125, it is especially designed for use in communication equipment with a final input power up to a quarter-kilowatt.

A SPECIAL feature of the M-125 transformer is the arrangement of the primary and secondary windings and the number of tappings brought out. These allow a wide variety of primary-to-secondary impedance ratios to be obtained, without sacrificing the efficiency of the operation. The tappings are brought out to ceramic insulated studs, which are identified by a code plate on the side of the transformer.



The manufacturers provide a data sheet showing the necessary interconnection of studs for various impedance ratios. These make possible a range of primary impedance values from 500 to 20,000 ohms, and of secondary impedance values from 500 to 30,000 ohms. Allowing for normal circuit tolerances, the transformer will therefore meet all normal transmitter requirements and can even be used as a plate-to-line transformer.

Nominal maximum power rating is 125 watts audio, while the insulation and current carrying-capacity of the secondary is adequate for figures normally encountered in a quarter-kilowatt final.

The audio characteristic is intended primarily to handle speech only at high quality, the nominal frequency response being quoted as 150-7600 c/s.

The M-125 is sealed in a metal tank, finished in grey crackle lacquer. The base area is approximately 5¼in. square and the overall height 7in.

Price and complete specifications are available from Ferguson's Radio, 12 McMahon St., Willoughby, NSW.

EDDYSTONE PRODUCTS

SEVERAL recent additions to the range of Eddystone products are of interest to amateurs. First is a semi-automatic Morse key which is completely housed in a streamlined, crackle-finished die-cast housing.

A similar finish is used for a signal strength meter intended for use with Eddystone 640 communications receiver. It is fitted with all necessary resistors and simply plugs into a socket at the rear of the receiver. A modulation indicator is also available in a similar housing, which employs two germanium rectifiers. It serves also as an excellent phone monitor.

Details of these products are available from Keith Harris Pty. Ltd., of 51 William Street, Melbourne, C1.

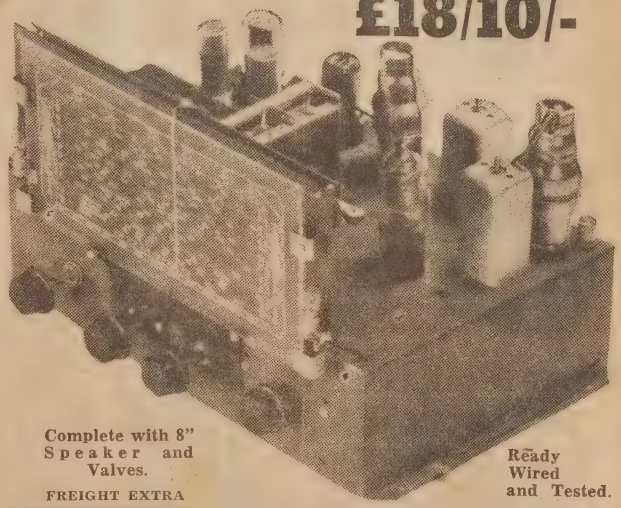
U.R.D. DISTRIBUTORS FOR GOODMAN'S LOW SPEAKERS

UNITED Radio Distributors announce that they have been appointed a wholesale distributor for the products of Messrs. Goodmans Industries, Ltd., England. This latter company is best known for its loudspeakers. Lines at present available include a standard and a twin cone 12in. permag., 15in. and 18in. permags., and the twin cone "Axiom Eighty."

The 12in., 15in. and 18in. speakers are already fairly well known in this country, but the "Axiom Eighty" is something quite new. It is a 9½in. twin free edge diaphragm unit with cantilever suspension to give wide-range reproduction. This permagnetic loudspeaker has a frequency range of approximately 20 to 20,000 CPS in free air, plus or minus 4db. It is intended for use only in a correctly-designed chamber which can be supplied by the manufacturers.

5-Valve D/W RADIO CHASSIS

£18/10/-



Complete with 8" Speaker and Valves.

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Ready Wired and Tested.

SPECIAL OFFER: — Complete as above with Phono pickup and Electric Phono Motor and Turntable, £24/-/-.

FERROTUNE UNIT — Comprising Chassis, 2 Iron Core IF Trans., dial tuning unit and coils, 35/-. Posted 37/6. With Spartan 5" Spker., 47/6.

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MAXWELL'S RADIO

Minivox

Kit sets complete

£8/1/6

DULCIE

English carbon Microphones with inbuilt transformer.

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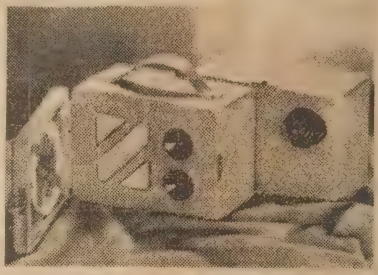
Ready and Easy to fit to any radio.



MULTI-TALKIE A/C or Battery Personal Portable

This set was presented in Radio & Hobbies July Issue. It works off A/C or Inbuilt batteries. 4-Valve Kit is complete in every detail at **£16/10/-**

Size 6¼in. x 3¼in. x 3 3-8in.
6 1-8in. x 2 3-8in. x 1 3-8in.

Multi-Talkie Set. Complete .. £13/5/-
Multi-Talkie Power Supply Unit £3/10/-
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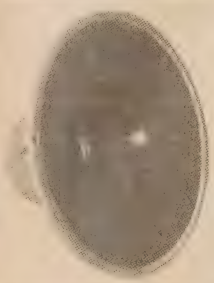

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NEW ROLA CATALOGUE

FULL technical details of the complete range of Rola loud-speakers, including the two new 12" models which are to be released shortly, are contained in the newly-issued Rola Loud-speaker Catalogue.

The Loud-speaker data includes power ratings, diaphragm resonance, voice coil impedance and mounting details. Also included in this attractively-printed booklet are details of

output and line transformers, their impedance ratings and their type codes, information on Rola filter chokes, and a nomograph setting out power, voltage and impedance relationships.

Articles on loud-speaker performance ratings and the development of modern magnet alloys will also interest all loud-speaker users. Copies can be obtained free from all Rola distributors or direct from Rola Company (Aust.), Pty. Ltd., The Boulevarde, Richmond, Victoria.

VALVES FOR 1949

A CIRCULAR to hand from the A.W. Valve Company sets out the types recommended for use in new equipment during 1949.

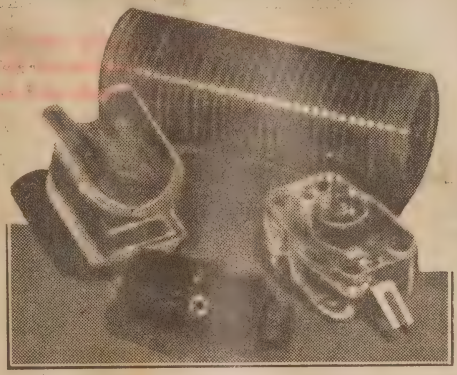
Type 5U4-G is recommended instead of the 5V4-G, while the 6J8-GA or the X61M replaces the conventional 6J8-G. A range of single-ended "GT" types is to be made available but notable omissions are the 6SF7-GT and 6SA7-GT. This latter valve is replaced by the miniature 6BE6 while the miniature 6BA6, 6AU6 and 6AV6 are also scheduled for production.

Of interest, too, is a complete range of European type valves for ac-dc receivers having a heater rating of 0.16 amp. These are fitted with a standard octal base.

Type 6J7-G/1620 takes the place of the older type 1603 as a non-microphonic amplifier, while type 807 remains in the list as a high power amplifier.

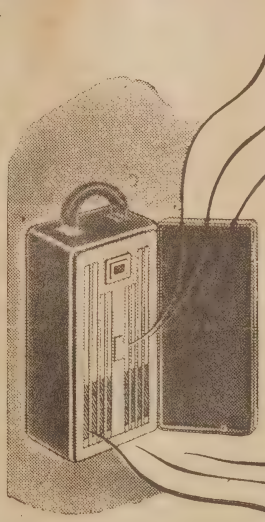
MOULDED PRODUCTS BY "JABEL"

UNDER the brand name "Jabel," a new line of small moulded radio components has been released on the Australian market. Those pictured on the left include a small "egg" type insulator, a 2-plate trimmer, a 465kc variable padder, spring terminals and a ¾inch diameter coil former.



The coil former is normally grooved at 16 TPI and can be supplied with a mounting base if necessary. The base can, in turn, be tapped to take a standard slug screw. The material in all cases is polystyrene.

The terminals are of the self-insulating type and are available in red or black. "Jabel" products are being distributed through normal trade houses, and trade enquiries may be addressed to Watkin Wynne, Factory Distributor, 173 Pacific Highway, North Sydney, NSW.



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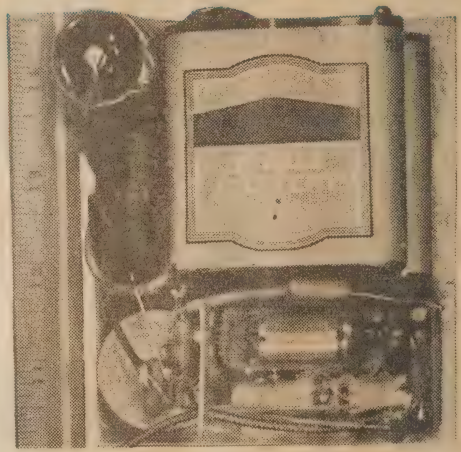
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

MINIATURE VERSION OF THE R & H "1Q5-ONE"

One of our regular readers, Mr. A. Wills, conceived the idea of building the "1Q5-ONE" to the same size as our circuit block. The accompanying photograph, taken in our studio, shows the results of his efforts.



RECENTLY, while looking through some back numbers of R & H, the writer noticed the "1Q5-ONE" circuit and decided to construct it on a front panel the same size as the circuit block.

The valve was changed to the miniature 3S4 and a midget tuning condenser was used in conjunction with a standard "Reinartz" coil with the base removed to conserve space. Before removing the base from the coil, however, first make a sketch showing the various leads, as it is very easy to connect the coil incorrectly if this is not done. If the secondary is wound with Litz wire be sure to clean every strand with fine emery cloth prior to soldering and be very careful not to break any strands.

The writer understands that one well-known coil manufacturer is preparing to place midget Reinartz coils on the market and, when these are available, they should be ideal for this set.

In the original set a small output transformer was used to enable low impedance headphones to be used. This transformer was taken from a disposals headset adaptor and, is an auto-transformer suitable for matching 500 or 600 ohm headphones to a 4000 ohm line. The core of this transformer is not inter-leaved but the d-c current through it is so small that the efficiency is not impaired.

The "A" battery is a single small 1.5 volt dry cell, which has quite a reasonable life, as the valve only draws about one-third of the current of a torch bulb. There is, however, sufficient room to include a second cell if the output transformer is omitted. The 3S4 could then be operated, if so desired, with the 3 volt filament connection.

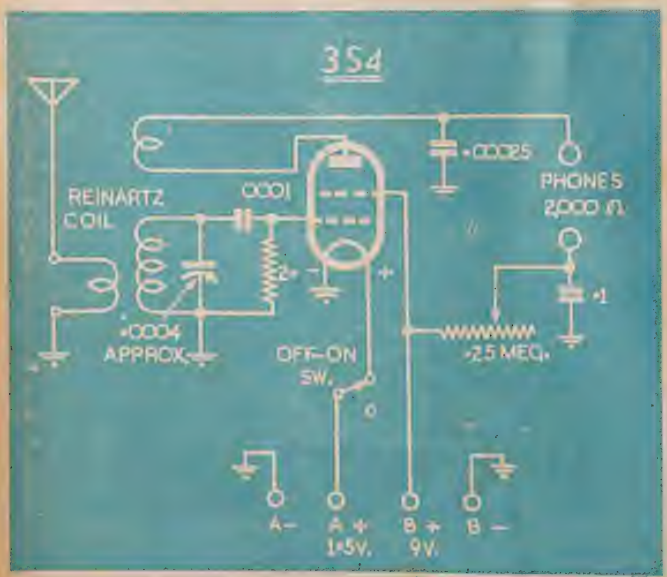
The "B" battery consists of two 4.5 volt torch batteries connected in series and their life should be considerable, as the HT current drain of this little set is only about 0.5 mA.

No difficulty was experienced in getting the set into operation; in fact, the original set operated from the moment it was switched on. With a reasonable aerial and an earth wire connected, the set will tune in all the local stations at excellent strength and there is no reason why it should not tune in some of the more distant stations if a really good aerial is used.

The reaction is very smooth and easy to control but, on a very weak station, careful adjustment is essential to ensure the best results.

The set could be housed in a small wooden box and it would then form a very neat and compact unit for use in a bedroom, while the batteries have good life and are very cheap to replace. A complete set of batteries costs only about 3/6.

In the opinion of the writer the performance of this set is amazing considering the simplicity of the circuit and the low HT voltage used. (From A. Wills, 342 Edgecliff Road, Woollahra.)



Mr. Wills' receiver has a front panel the same size as this circuit block—4¾" x 3⅝". His valve, however, is a 3S4.

THE *Axiom Twelve Twin*

by GOODMANS

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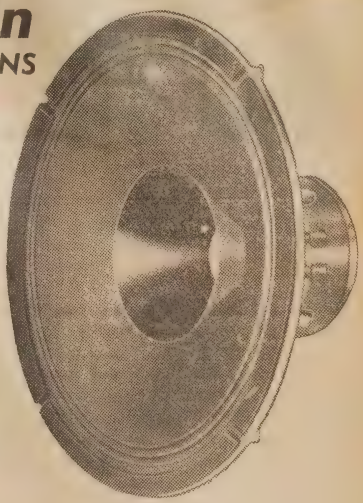

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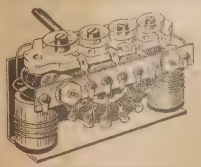

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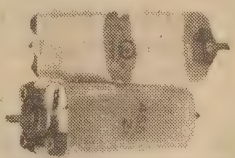

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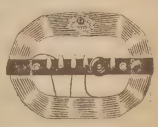

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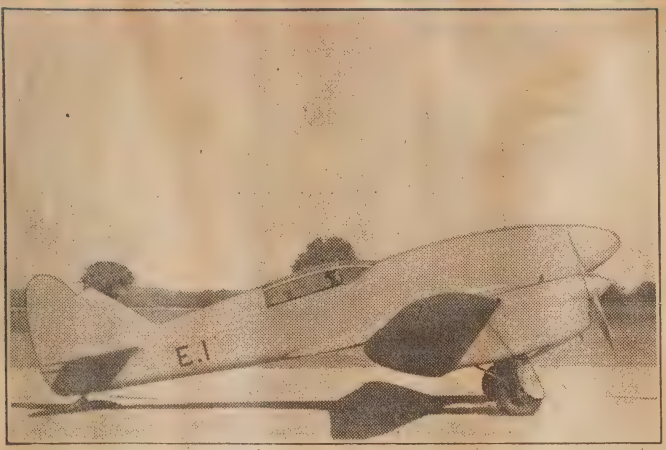


The de Havilland "Comet," which won the Britain-Australia air race in 1934.

In this article, E. C. Shepherd, aviation writer for the London Sunday Times, gives his reactions to the proposed Britain—New Zealand Air race to be held in 1953. By that date, some remarkable aircraft developments may be expected.

NEWS of plans to organise an air race from Britain to New Zealand in 1953 for prizes worth about £35,000 has been duly noted by the British aircraft industry.

As winner of the high-speed section of the 1934 race to Australia, Britain is naturally pleased with a date for the coming race, which will allow high-speed developments. In 1934 Britain won with a new and untried airplane specially designed for the race. This was the De Havilland Comet, a two-engined two-seater, which covered the 11,243 miles in 71 hours. The plane was not used afterward for any practical purposes, but some of its features appeared seven years later, in 1941, in the fast Mosquito bomber.

HANDICAP SECTION

The handicap section of the race was designed to encourage good qualities (including speed) in airliners and other types of civil aircraft. By 1953, Britain should know what she can do with the most revolutionary airliner now under construction. The new De Havilland Comet is jet-driven, and with a load of passengers should have a range in still air of 3500 miles. Without passengers the range might be put up, perhaps, by 1000 miles. The cruising speed, at a height of 40,000 feet, ought not to be less than 450 mph.

By that time also, certain other airliners of longer range but slower cruising speeds, will have done their flying tests. The Bristol Brabazon, due to fly toward the end of this year, will have a range of 5000 miles, and so will the corresponding Saunders-Roe flying-boat, described for the present as the S.R.45. If necessary, both these big aircraft could carry extra fuel instead of pay load, and so could largely increase their range. Speeds will exceed 300 mph.

Currently, there is no rocket-driven airplane in the world which could expect to make a journey of nearly 13,000 miles.

ROCKET DRIVE

All the rocket-driven aircraft flown up to now have had a duration of only a few minutes. The rate at which such motors consume their chemical fuels and the restriction of rockets to small aircraft for the purpose of getting the highest possible speeds, are responsible for this. The best rocket airplane of today would probably be limited to a range of less than 200 miles. Refuelling stages at intervals of 150 miles on a run involving two long sea crossings would rule out the rocket airplane now, but there is no guarantee that rocket-driven aircraft of sufficient range will not be flying in five years.

Doubtful starters though the rocket aircraft may be, there should be little difficulty in entering some jet-driven fighters by 1953. Britain now has two types of gas-turbine fighters which have a still-air range of 1000 miles. To have a reasonable margin on the long sea crossing, that range should be increased by at least half. These fighters, the Gloster Meteor and the De Havilland Vampire, have lately undertaken long journeys.

Research work directed to the improvement of British fighters has been in progress for some time. By 1953, the fruits of this development work should have been built into new fighters with more powerful gas turbines.

JET AIRCRAFT

There might be some impressive jet fighters capable of flying halfway across the world at speeds around 700 mph by 1953. The Comet, which won the race of 1934, had a top speed of only 235 mph, but it had a range of something like 3000 miles. If the Comet could make the journey to Melbourne in 71 hours, a modern fighter might cover the same distance in little more than a day and a night, provided it could count on a range of 1500 miles. Range, in this race, will evidently be of importance as it was in 1934 and, therefore, the most profitable line of speculation concerns the jet bombers, which should be appearing by 1953.

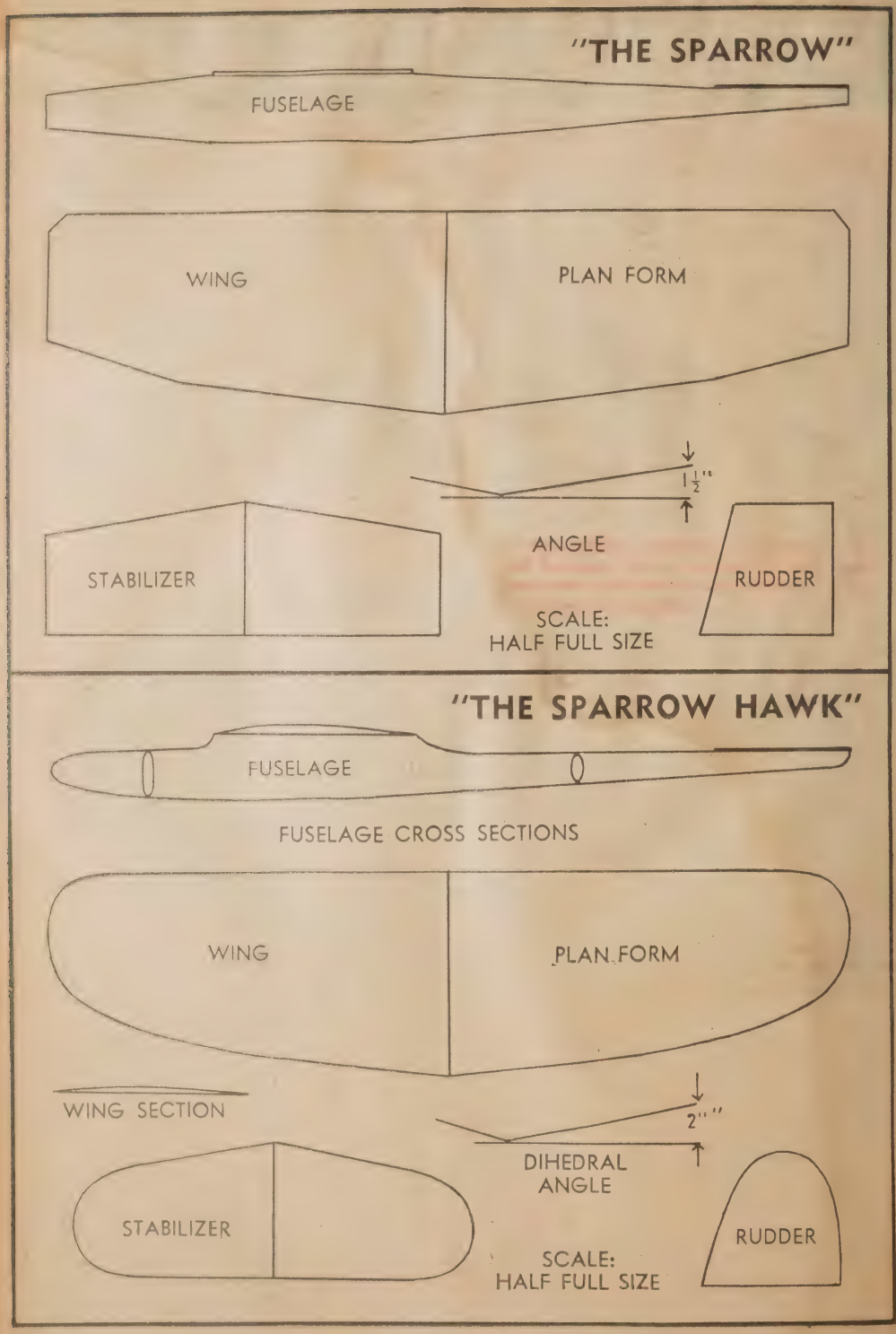
A small number of flying-wing jet bombers recently was ordered by the United States air forces. Britain's first jet bomber has yet to appear. This is the type of airplane which should combine high speed with useful range. Given good gas turbines and a well-designed airframe, there should be no difficulty in getting a speed of 600 mph and a range of fully 2500 miles The prospects of the British gas turbine are extremely good. The British lead in gas turbines is periodically acknowledged by American engineers.

by E. C. Shepherd

Aviation Standards

A SOLUTION for the aviation confusion in international flying due to use of English and metric units in aeroplane communication has been worked out in Montreal by the International Civil Aviation Organisation representing 48 nations, including the United States.

When this standard is reached, distance would be given in nautical miles, altitudes in metres, horizontal speed in knots and vertical speeds in metres per second. Wind direction and velocity would be in degrees and knots, cloud heights in metres, and visibility in metres or kilometres. Altimeter setting would be in millibars, temperatures in Centigrade and weight in kilograms. Time would remain the day, the day beginning at midnight, Greenwich mean time.


"THE SPARROW"
FUSELAGE
WING
PLAN FORM
1½"
ANGLE
STABILIZER
RUDDER
SCALE:
HALF FULL SIZE
"THE SPARROW HAWK"
FUSELAGE
FUSELAGE CROSS SECTIONS
WING
PLAN FORM
WING SECTION
2"
DIHEDRAL
ANGLE
STABILIZER
RUDDER
SCALE:
HALF FULL SIZE

SIMPLE MODEL GLIDERS FROM BALSA

Following on last month's description of a comparatively simple all balsa cabin model aeroplanes, we present this month two all balsa gliders, namely "The Sparrow" and "The Sparrow Hawk."

by Jack Finneran

WE chose these names as representative of the flight performance of the two models. The Sparrow will prove to be a capable but ordinary flyer, while the beautiful gliding and soaring flight of The Sparrow Hawk is akin to the flight of its namesake. We propose to show by plans and description how easily one may convert the simpler machine into a high performance job mainly by paying a little more attention to design and constructional details.

We would suggest that you scale up two sets of drawings, and as the plans are half scale, this will be a relatively simple job. The plan of the Sparrow Hawk can be drawn on top of that of the Sparrow by simply sweeping in the curves shown. This will make it very easy for you to get the graceful, curved lines of the Sparrow Hawk.

I think you will find it an excellent idea to make the two ships because the knowledge gained in the construction and flying of the simpler job will be of inestimable value to you when you start on the more ambitious project.

Once again we suggest you use the template method of cutting out your wing stabiliser, rudder, and fuselage parts. These templates can be made by superimposing the drawings on cardboard and then cutting the cardboard to the plan shapes.

Assuming you are building two models, the list of materials hereunder will suffice.

1 Sheet 1-8in. x 3in. x 36in. medium balsa.
1 Sheet 1-16in. x 2in. x 36in. soft balsa.
1 Sheet ¼in. x 3in. x 18in. medium hard balsa.
A small quantity of modelling clay.
1oz. tube or bottle of model aeroplane cement.
2oz. bottle of clear lacquer.

FUSELAGE CONSTRUCTION

Let us take the simple job first. Using our template, cut out the side pattern of the fuselage. This will prove to be very simple because there are no curves only straight lines to worry about.

Having cut out the side pattern from your ¼in. hard balsa, smooth it up nicely with medium and then fine grades of sandpaper and slightly round all corners, both top and bottom. This will complete the Sparrow fuselage.

If you are making the Sparrow Hawk at the same time, the same procedure will apply with the following modifications. Make sure that you get the smooth flowing lines of the top and bottom of the fuselage and pay great attention to securing the correct cross section of the fuselage also.

Make good use of your sandpaper to secure a nice, smooth finish, and apply two or three coats of lacquer with a light sanding between each coat. This will ensure a smooth highly polished surface, will do much to reduce drag, increase the models speed and climb and ultimately step up the overall performance of the ship.

WING CONSTRUCTION

Once again we will treat the Sparrow first. Perhaps we should issue a warning here because it is the wing construction which will play one of the biggest parts in the ultimate success or failure of these models, in fact of any model aeroplane.

Work carefully, and spare no effort to secure a well-built, strong, smooth wing. Using the templates as before, cut out your wing plan form from the 3in. medium sheet. Sandpaper the surfaces and slightly round all the corners. Having done this we can now put in the dihedral angle.

The best way to do this is to slightly score the under surface of the wing along the centre line. Lay one half of wing on your work bench and lift the other half up so it is 3in. above the bench. This will cause the wing to break along the centre line in the nature of a "green break." A liberal coating of cement at this point both top and bottom will be necessary so as to retain the angle formed.

That completes your wing. As before, the same procedure is adopted in the construction of the Sparrow Hawk, but with the following very important modifications. You will notice our wing shape is very akin to the shape of the wing plan form used by the greatest of all World War II fighter planes—The Supermarine Spitfire. This wing plan form is a highly efficient one, and it lends itself very well to hand launched glider construction.

You will also notice that an air foil section has been incorporated in the wing. This is secured by very liberal use of your sandpaper block. Careful attention to the duplication of this feature will pay you dividends in increased performance.

Another departure from the Sparrow wing is an increase in dihedral angle. This becomes necessary due to the higher speeds attainable from the Sparrow Hawk. Pay particular attention to the finish on the wing surfaces and bring them up to a nice finish with your sandpaper and lacquer. Apply several coats of thin cement at the wing centre section and allow to dry thoroughly between coats, as great strength is needed here as very great strain is placed on this joint when this machine is hurled into the air for long flights.

TAIL SECTION CONSTRUCTION

Select your piece of light 1-16 inch balsa and, using your templates, cut out the tail sections. Lightly sandpaper all part and round corners. In the case of the high performance job try and secure a rather pointed leading and trailing edge.

In so doing be careful not to weaken these parts too much, otherwise you may get tail flutter at high speed, and this can cripple performance. Lacquer and sandpaper this assembly to a high finish consistent with the finish on all other parts of the Sparrow Hawk. When cementing the rudder to the tailplane be careful to keep it at right angles and straight along the line of flight.

We now have each individual part of our model or models finished and the assembly and alignment details are all we need to finish them. There is no necessity to deal separately with each model here, as the same procedure will adequately cover both.

At this juncture you may cut a small "V" slot along the length of the fuselage at the wing position to accommodate the shallow vee of the wing and fill it with cement. Pin the wing firmly in position and make sure it is square across the fuselage and that each wing half makes the same angle with the fuselage when viewed from the front. Allow to dry and check a couple of times while it is still drying to see that it has not shifted position due to the pull of the cement as it dries.

The tail assembly is now cemented in position and care must be taken here to see that correct alignment is maintained between wing and fuselage. When the cement has set firmly at both wing and tail joints it is advisable to re-cement all parts again so as to secure a good bond between the fuselage and wing and tail assemblies.

(Continued on Page 77)

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SPOONS, Dessert, 2/- ea. Soup, 2/- ea. Tea, 1/3 ea. FORKS, Dessert, 2/- ea. Table, 2/9 ea. Add postage.

BOMBSIGHTS

WATER DAMAGED

Ex-Air Force. Useful component parts include 24v. motor. Best quality lenses, 12/6 ea.

Postage N.S.W., 2/6. Interstate, 3/6.

Serge Army TUNICS

BRAND NEW KHAKI

Woollen Serge, S.D. TUNICS. Sizes 4 and 5 only. Unbeatable for warmth and hard wear. ONLY, each **11/6**

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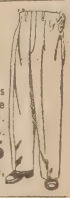
BRAND NEW

The best work trousers it's possible to get, as any of the boys from Army will tell you. Worth 30/- a pair. All sizes. PRICE **17/6**

Post, N.S.W., 1/-; Interstate, 1/6.



JUNGLE GREEN SHIRTS

We have just landed a huge purchase of these jungle green shirts and will never again be able to sell this exceptional quality shirt at this price. 27/6 value.

OS and XOS **12/6**

Post, N.S.W., 9d. Interstate, 1/3.

Army Slouch Hats Brand New

Genuine Fur Felt. All sizes. The hat for all purposes. Complete with chin strap, ea. **7/11**

Please state size. Postage N.S.W., 1/-. Interstate, 1/6.

MOSQUITO NETS

Ex-Army. Green. Brand New. Originally cost the Army 35/-. Postage 2/- extra. **14/6**

FOUNTAIN PENS

Good English make, brand new, while they last .. .. **6/- ea.**

POST FREE.

SHOES

Best quality white canvas shoes, made in England, leather soles; ex-Royal Navy; brand new. Sizes 8 and 9 only. Worth 42/- pair. OUR PRICE 15/11

American Mosquito Proof Hammocks

BRAND NEW

Easy access with zip fastener. Strongly made, complete with ropes, etc. Worth every penny of £8/10/-. Our special price, 37/6 each. Post N.S.W., 1/6. Interstate, 2/6.

REFLECTOR GUNSIGHTS

Ex-Air Force. Containing best quality condenser lenses and adjustable reflector. Parts can be used for many purposes.

39/6 ea.

Postage 2/6 extra.

COMPONENTS INCLUDE THESE VALUABLE LENSES.

1 2 3 4 5 6

No. 1 Diam. 3 5-8 Foc. Len. 10in. No. 2 Diam. 3¾ Hollow Ground. No. 3 Diam. 3¼ Foc. Length 4½in. + No. 4 Diam. 2 3-8 Foc. Length 6½in. + No. 5 Diam. 1 1-8 No. 6 Diam. 1 1-18 Amber Coloured ordinary.

GREASE GUNS

ZERC PUSH-TYPE GREASE GUNS, EX-ARMY. 3oz., slightly used, perfect order .. 9/6 each 10oz., slightly used, perfect order .. 15/- each

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Extra Special Wet Weather Offer

Brand new RAINCOAT, Army anti-gas; 1 brand new sou'wester; 1 pair brand new waterproof Gauntlets.

The Lot For 11/-

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Black Oilskin SOU-WESTERS

ALL SIZES.

Ex-Navy. Brand new, original price, 13/6. These are super quality. Out they go. EACH **3/6**

Post 6d. N.S.W.; Interstate, 9d.

Military OVERCOATS

BRAND NEW, ALL SIZES.

For warmth and hard wear, these coats are unexcelled. Worth at least £5. OUT THEY GO **45/-**

Post, N.S.W., 2/-; Interstate, 3/6.

Haversack Bargain

They are water-marked and soiled, but only need a scrub to be as good as new. Suitable for School Bags, Fishing, Hiking, Bicycle, Tool Bags, etc. THE BARGAIN OF THE DAY. Complete with Strap **1/3**

POST 6d.

HEAD PHONES

Brand new, S.T.C. and Stromberg- Carlson. We have just made another purchase of these brand new 'phones, complete with cord and plug, and we are now able to sell them at the ridiculously low figure—130 ohms impedance **9/6**

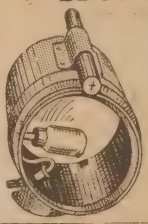
Postage 1/6 extra.

2000 ohms impedance **£1**

Suitable for crystal sets.

PLEASE NOTE: These 'phones are brand new, ex-Army, and not military rejects.

SPOT LIGHT



Ideal for fishing, hunting, shooting. Brand new. Original cost £2/15/-. Our price, complete with stand,

17/6

Freight 3/-.

Or complete with P.M.G. Morse Key and light, 23/- .

SORRY, NO C.O.D.

NOTICE OUR NEW ADDRESS PLEASE:

DEITCH BROS.

70 OXFORD STREET, SYDNEY.

DC-6 GIVES SAFE, QUICK FLIGHT

A LOW-WING four-engined monoplane, the DC-6, looks very much like the DC-4. Both these passenger aircraft are developed from the wartime C-54, a combat air transport widely used by the US Army Air Force.

Many improvements and refinements have been built into the DC-6, however. These differences in structure and comforts have been possible as the result of experience gained in thousands of hours of wartime and civil operation of the DC-6's predecessors.

The aircraft first appeared on American airlines in the first half of last year.

Use of a new "miracle metal," 75 S, for the skin of the aircraft, has reduced weight, which can be translated into cargo. The aircraft flies so easily by automatic controls that the flight engineer's station has been eliminated, cutting down the crew number.

CABIN COMFORT

The DC-6 cabin is completely air-conditioned, and has radiant heat in floors and walls.

Engine noise is muffled by a mica sheet which is cemented inside the fuselage skin, over which is a porous fabric.

The aircraft has a thermal de-icing system and de-icing apparatus on propellers. Dry-air intakes reduce the possibility of engine failure during storms, and cockpit window defrosting reduces visibility "blackout."

Fully reversible propellers cut down landing-roll and simplify ground handling.

"Preloaded cargo" features are incorporated. Separate crates are shaped to conform to the underside of the DC-6 hull, and may be loaded and then run out to the plane on the tarmac. The cargo hatch-doors are lowered, the loaded crates aboard the craft are taken off and the new crates put on. This arrangement cuts down ground-handling time considerably.

Two prototypes were produced. One was designated the 477 B, the other 496 B.

RADIAL MOTORS PREFERRED

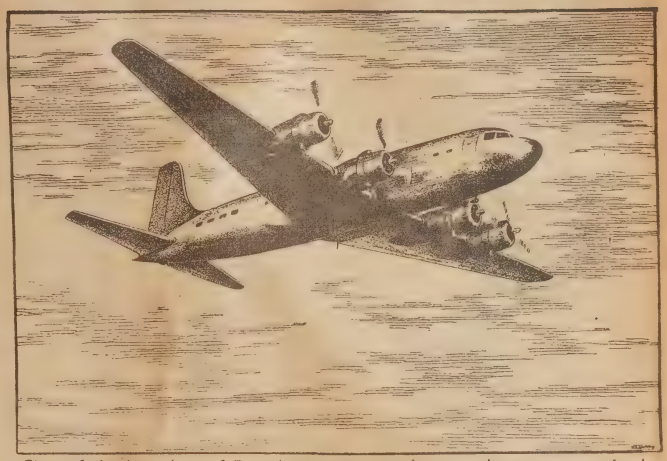
The 477 B, powered by four Pratt and Whitney R-2800 engines each developing 2100 horse-power, proved the more popular with airline operators. The 496 B was powered by four Allison in-line V-1710 liquid-cooled engines of 1630 horse-power at take-off.

Either type has accommodation for 56 passengers, but one version of the 477 B can carry 70 and another is a long-range model carrying two 500-gallon wing-tip tanks.

Gross weight of the DC-6 is 81,500 lb, and the plane can lift 60001b of cargo in addition to its passenger load.

Maximum speed is 300 miles an hour, and cruising speed 250 miles an hour. Service ceiling is 27,400ft., with best operating altitude set at 20,000ft.

Main dimensions of the aircraft are: Wingspan, 117ft. 6in.; length, 100ft. 7in.; and height, 28ft. 5in.



First of the long line of Douglas passenger planes to have a pressurised cabin, the DC-6 can carry up to 70 passengers. Offering the most advanced features of comfort and operating efficiency, the DC-6 represents an advance on the well-established DC-4 Skymaster, now operating on main Australian trunk routes and on the transpacific service.

MAKING TWO SIMPLE GLIDERS

(Continued from Page 75)

Before sending your model on its maiden voyage the following precautions should be taken, namely: Check very carefully for any warps in the wing or tail surfaces, as these can be fatal, particularly as these gliders fly at quite high speed. Remove any untoward warps or twists by steaming the affected parts and twisting back into alignment. Check for balance and add small quantities of modelling clay at the extreme nose until the planes balance at a point one-third of the wing chord back from their leading edges.

You are now ready to try your first flight. Pick a nice quiet day devoid of wind and fly for preference over a grassy spot. First try small trimming flights by spearing the model away from you at a gentle downward angle and correct diving tendencies by removing clay and stalling by adding clay until you are getting a nice smooth, straight glide.

Correct any turning tendencies by warping the rudder as a corrective measure. Gradually work up the speed of your launch until you are getting nice height and long flights. Glider launching is rather a subject in itself and we will have more to say about it later on.

DIRECTION FINDER GIVES INSTANT BEARING READING

RADIO direction finding, although obscured by radar publicity, was advanced materially by wartime research. Improvements will be useful in monitoring and administrative control of aircraft flights, rescue operations, and location of illicit transmitters.

Operation of new US Signal Corps finders is as simple as tuning a radio receiver. The desired signal is tuned in and a propeller-shaped indicating pattern appears on the indicator screen of a cathode-ray tube phasemeter.

Pattern tips indicate the direct and reciprocal bearings against an azimuth scale on the screen. Pressing a sense switch produces a folded pattern that arrow-like points to the direct bearing. High sensitivity depends on the electronic goniometer made up of antenna, balanced modulators, and a combining impedance. All moving mechanical parts have been eliminated.

For aircraft navigation, several direction finders are operated on base-lines and position fixes on transmitters are found by triangulation. Observed bearings are relayed to a central point for plotting. In aircraft homing, a reciprocal bearing is relayed to the aircraft.

THE FIRM FOR ALL YOUR RADIO REQUISITES

Radio Technical Books

We have just received a large assortment of the world's best authors, and selling them at a reduced price. All these books are in excellent condition, most being brand new. Unfortunately, we have only a limited quantity of a certain few, so it will pay you to order your books as early as possible.

Wireless Direction Finding by Keen 6/6
Ultra High Frequency Technique, by Brainerd, Koehlet, Reich & Woodruff 22/6
Modern Radio Servicing, by Ghirardi 27/6
Testing Radio Sets, by J. H. Reyner 7/6
Radio Receiver Design, by Sturley 15/-
Handbooks, Wireless Telegraphy Admiralty. Volume No. 1 . . 4/-
Volume No. 2 . . . . . 4/-
Amateur Radio Handbook (Reference Edition) 4/-
Foundation of Wireless by Scroggie 3/6
Radio at UHF, R.C.A. 5/-
Cathode Ray Oscillographs, by Reyner 6/-

We have many more to choose from, space does not permit describing fully.

Electrolytic Condensers

Having obtained a very large quantity of the above condensers at a reduced cost, we are in a position to offer you the benefit of this saving. Just glance through the following list.

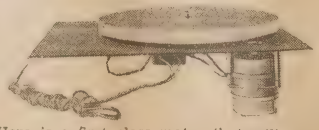
500 Mfd 12 Volt Wkg. Tub. Can. Reduced from 4/6 to . . . 2/-
8 x 8 x 8 Mfd 450 Volt Wkg Can. Reduced from 8/6 to . . . 4/6
8 x 8 x 8 Mfd 500 Volt Surge Proof Sq Block type. Reduced from 8/6 to 4/6
4 Mfd 450 Volt Tubular Can. Reduced from 3/6 to 1/6
50 Mfd 50 Volt Tubular Can. Reduced from 2/6 to . . . 1/3
250 Mfd 25 Volt Block type. Reduced from 2/6 to . . . 1/3

FIXED CONDENSERS

The following condensers have been manufactured especially for the British Admiralty, and we have been fortunate to obtain a quantity of various sizes. Our prices have been cut to bedrock, so now is your opportunity to purchase your condensers at a reasonable price.

Cap.	Voltage	Working	Tubular	Price
.001	2000	W	B	2 0
.0011	28000	T	B	4 3
.0028	2500	T	B	4 0
.002	400	W	T	1 0
.005	2500	W	B	2 0
.005	6000	W	T	3 0
.01	1000	W	T	1 0
.01	5000	W	T	3 6
.01	5000	W	B	4 6
.01	4000	T	B	2 0
.01	3750	W	T	2 6
.02	8000	W	T	5 0
.023	450	W	T	9
.025	6000	W	B	4 6
0.3	5000	W	B	5 6
.1	1000	W	T	1 9
.1	2000	W	B	2 6
.1	3000	W	T	2 9
.1	4000	W	B	3 0
.1	6000	W	B	3 0
.25	2000	W	B	3 0
.25	6000	T	B (Sub D)	6 6
.25	6000	T	B	3 6
.25	2500	W	B	3 3
.3	500	W	T	1 6
.25	1000	W	T	3 0
1	1500	W	B	7 6
1	2000	W	B	8 9
2	350	W	T	2 6
2	500	W	T	2 6
2	800	T	T	1 6
2	1000	T	B	2 6
4	350	W	T	2 0
50	12	Electrolytic		1 3
50	40	Electrolytic		1 9
75	12	Electrolytic		1 6
1x 1x .01	2250	Test Star Cond		1 0
4 mfd	1000	B		5 0
.5	8000	B		6 6

EXTRA SPECIAL GENUINE ENGLISH GRAMOPHONE MOTORS



Here is a first class motor that will cost you only half the price of others on the market. Rim drive, constant speed with synchronous type self-starting motor, very reliable and nice appearance.

A real bargain at . . . £4 15 0

English Pickups

Acos GP10 Crystal £2 8 6
Acos GP6 Magnetic 2 4 1

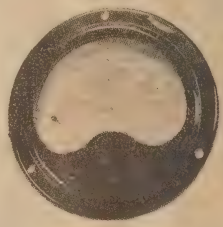
Both these pick-ups are reliable jobs with first class tone and performance.

CRYSTAL MICROPHONES

Acos English, can be fitted to any ordinary microphone case.

Price £1 8 2

METERS 0-1 PULLEN



These meters have been accurately calibrated, with the correct internal resistance of the meter calculated and engraved on the case. Each meter has the scales: Ohms, M/A, Volts, AC and DC engraved in separate colours for easy reference. We do not know of a better meter than this for accuracy, at anything like the price of this instrument. You will indeed be pleased with this meter. Remember, we have only a limited quantity available, so be early with your order. Our special price 35/- each.

VALVES

If you are requiring radio valves, that are in short supply, why not write to us. We carry a large stock, and will possibly have just the valve you have been unable to procure. For your benefit, we list a few valves that are hard to get, at prices that will be of interest.

100 T.H. Eimac 100 watt Transmitting 60/-
5BP1 5" Cathode Ray Tube . . 41/6
2 x 2 High Voltage Rectifier . . 16/-
VR91 EF50 . . . . . 16/-
UR 56 EF36 . . . . . 13/3
954 . . . . . 16/-
955 . . . . . 16/-
UT89 89 . . . . . 16/-
UT56 56 . . . . . 16/-
9006 . . . . . 16/-
9004 . . . . . 16/-
CU66 RL37 . . . . . 13/3
6C4 . . . . . 16/-

All valve prices include sales tax or excise duty. All valves are brand new and in original cartons.

MOTOR SPARES LTD.

547 ELIZABETH ST. MELBOURNE.

MAKING AN ELECTRIC DOOR CHIME

Electric door chimes are extremely popular, and rightly so, as they give a dignified note of warning, and their unusual yet pleasing appearance is a sure attraction to the wandering eye. The door chime described in this article is of an easy and straightforward design, and can be made by the average handyman in very few hours. With perhaps one or two exceptions, the material required can be salvaged from the scrap-box and with a little care and patience, the result will be a first-class instrument.

BEFORE proceeding with the constructional details, a brief outline of its actuating mechanism will enable readers to follow its working principles. The actuating mechanism consists essentially of a solenoid working a spring loaded striker-rod against two parallel tubular chimes or gongs. Upon the depression of the door push-button, current flows round the solenoid coil and exerts a strong magnetic field which rapidly attracts the striker rod, causing it to strike a sharp blow on one of the tubular chimes. When the push-button is released, breaking the circuit, the striker-rod is returned to its former position by the return spring, and when at the limit of its travel, strikes the other chime.

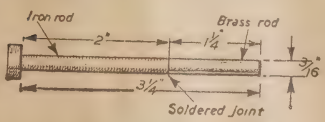


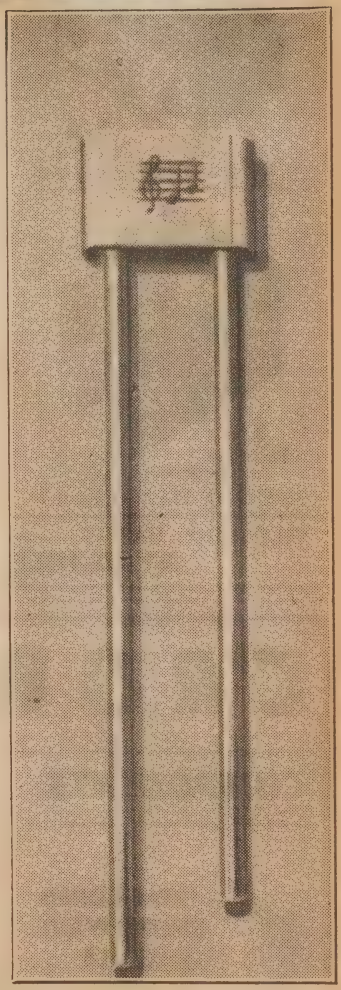
Fig. 2. Details of the striker array.

THE SOLENOID FORMER

To make the solenoid a former is required. This is made by folding a piece of thin cardboard 2½in. by 2½in. around a ¼in. rod, and well gluing the free edge down. The former should then be put aside to dry. Two end pieces are next made from smooth wood, ¼in. by 1½in. by 1½in., and are shaped as shown in Fig. 1. A 5-16in. hole is drilled with a centre-bit in the exact middle of each end piece to accommodate the former. The striker-rod bearings are made from thin brass plate screwed on to both end pieces, and a 3-16in. hole drilled in same concentric with the hole previously drilled in the end pieces. Next glue the former in the holes in the two end pieces, making sure that the former is pushed home as far as it will go, and that the whole assembly is in perfect alignment. Then put aside for the glue to harden.

WINDING THE COIL

For the winding two ounces of No. 26 cotton covered wire will be required. Commence winding by leaving a free end of about 6in. The winding should be carefully and evenly done, and after each row, glue or paste a piece of cartridge or drawing paper over same. This not only provides additional insulation, but enables the winding to be done far more accurately than would otherwise be possible. When the winding is completed, leave a further 6in. of wire at the finishing end. To prevent the wire unwinding, twist the two ends together, and paint the coil fairly liberally with shellac varnish. The coil should then be put aside in a warm place to dry and thoroughly harden. When dry, a second coat of shellac varnish is applied, and when same is "tacky" a piece of cartridge paper, or thin cardboard, is applied for finishing purposes. A pleasing appearance can be given by finally applying a short length of industrial tape to the coil. This tape is stocked in a



How the door chimes will appear when the job is finished.

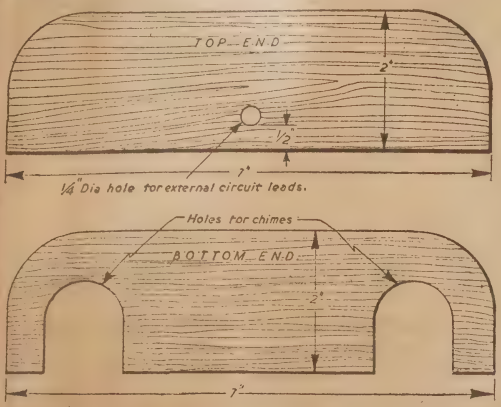


Fig. 4. Shape and dimensions of bottom parts of the cover.

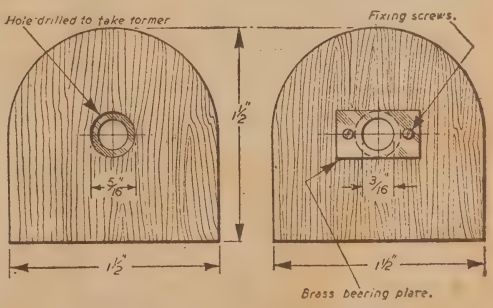
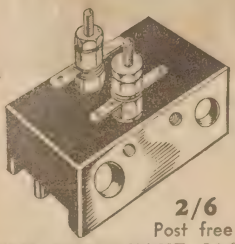
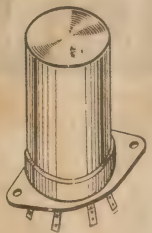


Fig. 1. End pieces for the solenoid coil.

ARMY DISPOSALS EQUIPMENT

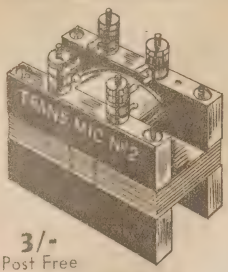


2/6
Post free
TWIN HEADPHONE JACK

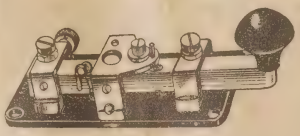


10/-
Post Free
EF50 VALVE and SOCKET

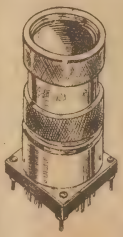
5/-
Post Free
HIGH TO LOW IMPEDANCE HEADPHONE TRANSFORMER



3/-
Post Free
MICROPHONE TRANSFORMER (Carbon)



3/-
MORSE KEY



5/6
Post Free
26 PIN PLUG and SOCKET. 2 large pins for heavy current. Pins are silverplated.

PARAGON RADIO

TELEPHONE: UA2145 ——— BOX 14, P.O., HABERFIELD (SYDNEY) N.S.W.

AVAILABLE ALSO AT:—No. 5 ROYAL ARCADE

CROWN . . .

COMPONENTS

IRON CORED SHORT WAVE COILS

Iron Cored Short Wave Coils: I.C.62 aerial, I.C.63 R.F., I.C. 64 Oscillator, 13 to 42 metres for use on Standard H gang.

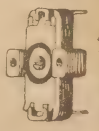
PRICE 4/9

455 KC STANDARD PERMATUNED I.F. TRANSFORMER

in aluminium can. First stage PT. 31, Second Stage PT. 32.

PRICE 13/9

P12. STANDARD 5-PLATE PADDER CONDENSER:



455 KC. using Polystrene base. For use in conjunction with H gang condenser.

PRICE 2/6

R.F. CHOKES

R.F. Choke. Standard general purpose honeycomb winding will carry up to 50 M/A.

PRICE 1/10

AIR CORED S/W COILS

Air Cored S/W coils, 13 to 42 metres, Z.C. 59 Aerial, Z.C. 60 R.F., Z.C. 61 Oscillator. For use with H gang . .

PRICE 2/10

M.E.B. TRIMMER CONDENSER

M.E.B. Trimmer Condensers: 2 to 35 MMFD on Polystyrene base.

PRICE 1/1

DP 3A TUNING UNIT, 3 stage, range 13 to 42 metres, 1600 to 550 KC. PRICE, £4/17/0.

B.F.O. 455 KC OSCILLATOR COILS. PRICE 12/- ea.

R.F. COIL with reaction, in aluminium can. Price 9/10. Reinartz Coil, in aluminium can. PRICE, 7/6.

D.C. 2A TUNING UNIT, 13 to 42 metres, 1600 to 550 KC. PRICE, 36/-.

Crown

RADIO PRODUCTS PTY. LTD.

51-53 MURRAY STREET
PYRMONT — SYDNEY

Telephone MW2023 (2 Lines)

variety of colors, and its glossy surface considerably enhances the appearance of the finished coil.

STRIKER-ROD

The striker-rod is made from a 3-16in. by 3in. iron bolt. The length of the bolt is reduced to 2in. with a hacksaw, and a piece of brass rod, 3-16in. diameter, and 1¼in. long, is then carefuly soldered on to the end of same, care being taken to see that both the bolt and the brass rod

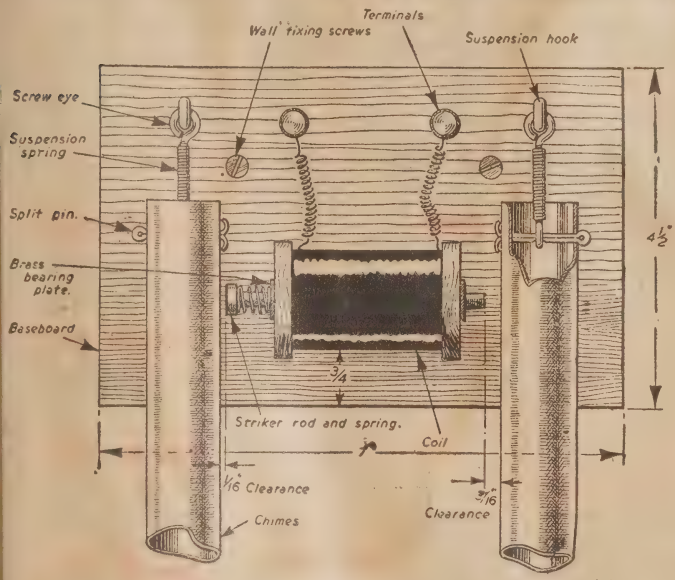


Fig. 3. Layout of the bobbin, striking pin, and chimes ready for use.

are in perfect alignment (Fig. 2). Readers are advised not to deviate in the measurements given for the striker-rod assembly, as these have been carefully calculated to obtain the maximum thrust from the magnetic field. The striker-rod should now be cleaned up and burnished with fine emery paper, and should be tried in its bearings to make sure that it has free and easy movement. A light coiled spring ½in. long is required, and should be placed into position between the bolt head and the striker-rod bearing, as shown in Fig. 3. Quite a satisfactory spring can be made by unravelling a length of light bowden wire, and winding one of the strands around the striker-rod until a spring of suitable tension and proportions is formed.

This completes the striking mechanism, and the baseboard can now be made from a smooth piece of wood ½in. by 7in. by 4½in. The coil is screwed to the baseboard in the position shown, and the connecting wires, after being coiled, are connected to two terminals screwed into the baseboard.

TUBULAR CHIMES

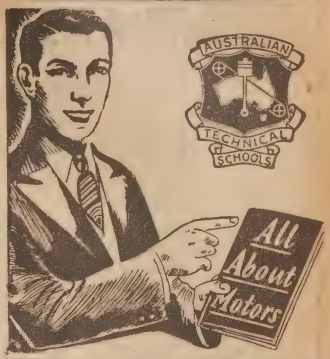
For the chimes, the writer obtained two lengths of 1in. diameter solid drawn brass tubing, one length being 3ft., the other, 2ft. 9in. It was found that this tubing gave a deep, mellow tone, and the two varying lengths made, of course, the dual notes which are a feature of the chimes. Should any difficulty be experienced in obtaining the tubing, it is possible that a musical instrument store can supply tubular bells, which would, of course, suit the purpose admirably. Or again, perhaps, a second-hand store may be in the position to assist in this matter.

The chimes are suspended by two small springs from hooks placed as high as possible on the baseboard. The suspension springs are of 1in. length, and a small screw eye is screwed into each end of the spring. A suitable kind of spring is the type used for hanging curtains. This spring is stocked by popular stores, and a small length together with the necessary screw eyes can readily be obtained.

To attach the springs to the chimes, drill two small holes in each chime a ¼in. from the top, then holding the screw-eye in line with the two holes, pass a split-pin through same and secure. It is advisable to file a small groove in the middle of the split-pin prior to assembly, in order to locate the screw-eye in position.

The chimes should be located in relation to the solenoid as follows: The impulse chime, that is, the chime which is struck by magnetic impulse, should be located 3/16in from the extreme end of the striker-rod. The rebound chime should be positioned 1/16in distant from the opposite end of the striker-rod when same is normally at rest. It is not advisable to locate this chime in direct contact with the striker rod, as otherwise the note may be muffled. The rebound caused by the return spring will, of course,

MOTOR-CAR ENGINEERING



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RED LINE

TRANSFORMERS OF DISTINCTION

RADIO RECEIVER TYPE

The transformers listed in this section have been designed specifically for use by manufacturers in standard types of radio receiver sets; but they may, of course, be applied to any electrical apparatus for which their specifications make them suitable.

Coil temperature rise with continuous operation will not exceed 30-35 degrees Centigrade over ambient.

These units are constructed to permit sub-panel wiring, and are fitted with drawn steel covers finished in smooth transmission grey.

All these units are baked and impregnated with super insulating varnish and are specifically made for use under adverse climatic conditions.

Item 1. — **Type No. 4212**

Prim: 240v . . . 35vA — 50 cps
H.T.: 210 CT 210v — 40 mA
Fils: — 5v-2A 6.3v-3A
Base: 3 x 2½ x 2" H — Wgt 2lb 8oz
Mntg: H2 — "S" is 1¼"

Item 2. — **Type No. 4282**

Prim: 240v . . . 37vA — 50 cps
H.T.: 280 CT 280v — 40 mA
Fils: — 5v-2A 6.3v-2A
Base: 3⅜ x 2⅞ x 1¾" H — Wgt 2lb 13oz
Mntg: H14 — "S" is 1"

Item 3. — **Type No. 6382**

Prim: 200-230-240v . . . 45vA — 50 cps
H.T.: 385 CT 385v — 60 mA
Fils: — 5v-2A 6.3v-2A
Base: 3⅜ x 2⅞ x 3" H — Wgt 3lb 12oz
Mntg: H14 — "S" is 1⅜"

Item 4. — **Type No. 6292**

Prim: 200-230-240v . . . 40vA — 50 cps
H.T.: 290 CT 290v — 60mA
Fils: — 5v-2A 6.3v-2A
Base: 3⅜ x 2⅞ x 1⅜" H — Wgt 3lb 2oz
Mntg: H14 — "S" is 1⅛"

Item 5. — **Type No. 8383**

Prim: 200-230-240v . . . 60vA — 50 cps
H.T.: 385 CT 385v — 80 mA
Fils: — 5v-2A 6.3v-3A 2.5v-5A
Base: 4 x 3½ x 2⅛" H — Wgt 4lb 14oz
Mntg: H10 — "S" is 1¼"

Item 6. — **Type No. 8382**

Prim: 200-230-240v . . . 60vA — 50 cps
H.T.: 385 CT 385v — 80 mA
Fils: — 5v-2A 6.3v-3A
Base: 4 x 3½ x 2⅛" H — Wgt 4lb 12oz
Mntg: H10 — "S" is 1¼"

Item 7 — **Type No. 8302**

Prim: 200-230-240v . . . 54vA — 50 cps
H.T.: 300 CT 300v — 80 mA
Fils: — 5v-2A 6.3v-3A
Base: 4 x 3½ x 1¾" H — Wgt 4lb 2oz
Mntg: H10 — "S" is 1"

Item 8. — **Type No. 10382**

Prim: 200-230-240v . . . 62vA — 50 cps
H.T.: 385 CT 385v — 100 mA
Fils: — 5v-2A 6.3v-3A
Base: 4 x 3¼ x 2¼" H — Wgt 5lb 11oz
Mntg: H10 — "S" is 1½"

Item 9. — **Type No. 10302**

Prim: 200-230-240v . . . 52vA — 50 cps
H.T. 300 CT 300v — 100 mA
Fils: — 5v-2A 6.3v-3A
Base: 4 x 3½ x 2" H — Wgt 4lb 10oz
Mntg: H10 — "S" is 1¼"

Item 10. — **Type No. 12382**

Prim: 200-230-240v . . . 80vA — 50 cps
H.T.: 385 CT 385v — 125 mA Cond. Input
Fils: — 5v-2A 6.3v-3A
Base: 4 x 3½ x 4¼" H — Wgt 6lb 9oz
Mntg: H10 — "S" is 1¾"

D.C. Volts	Choke Input	Cond. Input
5V4	310v	430v
5Z3	300v	400v
5Y3	275v	360v

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A GUARANTEE OF DEPENDABILITY

easily bridge the small clearance left between the chime and striker-rod.

COVER

Having correctly set up the chimes, there remains only the cover to make to complete the instrument. The shape and dimensions of the two cover ends are as shown in Fig. 4. It will be noted that the bottom end has two "U"-shaped holes cut in it, to accommodate the chimes. These holes can, of course, be easily made with either a fretsaw or keyhole saw. The top end has a ¼in hole drilled in same, centrally located and ¼in distant from the back edge, to allow connection to be made to the terminals with the external circuit. (See Fig. 3.) A piece of smooth tinplate 11in. by 4½in. is next carefully shaped around the two ends and is secured into position with panel pins. The heads should be carefully punched below the surface of the tinplate, then filled in with soft-solder, and subsequently filed smooth until level with the surrounding surface. Any file marks should be removed with fine emery paper, and it should be impossible to detect the heads of the panel pins if the job is carefully done.

FINISHING

The cover should now be given two or three coats of good quality enamel, and when thoroughly dry, an ornamental motif may be applied or painted on.

The cover is a push fit over the baseboard. Should it be found to fit loosely, slightly bend the projecting sides inward to increase their tension on the baseboard. The complete assembly is screwed to the wall by drilling two holes in the baseboard, and screwing into position. Care should be taken to see that the chimes hang absolutely vertical, as otherwise their position in relation to the striker-rod will be disarranged and the chimes will not operate satisfactorily.

The chimes may be connected to the 8-volt circuit of a bell transformer, or alternatively to two 4½-volt dry batteries connected in series. It is advisable to keep the external circuit wiring as short as possible, to prevent undue voltage drop. The chimes should function indefinitely without any attention beyond occasionally one or two drops of thin cycle or machine oil on the striker-rod bearings.

"FROSTING" A GLASS WINDOW

TO get a "frosted" appearance on the surface of glass, dissolve 10 parts of cooking gelatine in 90 parts of hot water. Then stir in sufficient whiting to give the liquid a strong milky appearance. Brush the resulting liquid on to the window and allow it to set hard. It will produce a semi-opaque film. Several applications can be given.

If the hard film thus deposited on the window is gently sponged over with a mixture of equal volumes of water and formalin solution and then allowed to dry, the formalin will render the gelatine insoluble.

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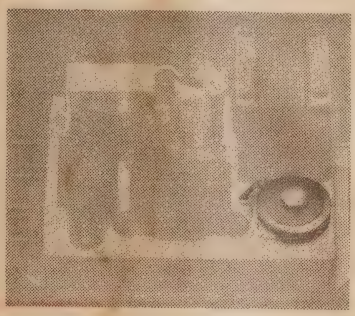

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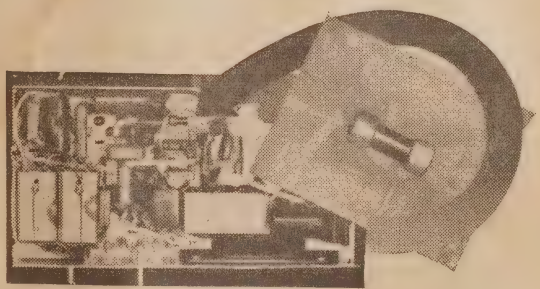

WX6 WESTECTOR—as used in the "R. & H." 4-48 Receiver is a tiny half wave copper oxide rectifier, measuring only 17/32" x 7/32".

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SHORT WAVE NOTES BY RAY SIMPSON

TWO NEW COUNTRIES ON S.W. BANDS

CYPRUS AND PAKISTAN

With the innumerable short wave stations now on the air it becomes very difficult to log any new countries but the last few weeks have brought to light two new ones, Cyprus and Pakistan.

READERS will remember the Forces Broadcasting Station which used to be located in Palestine and transmitted on 6.07 mc. and also on 7.22 mc. On the termination of the mandate in Palestine, these stations were closed down, and it was then reported that they would eventually again be put into operation from the island of Cyprus, which of course is a British Crown Colony.

This information has proved to be correct as the Forces station has now been heard on its old channel of 7.22 mc announcing as "This is your Forces Broadcasting Station in Cyprus." No call letters have been heard, but it can be identified when it leaves the air at 6.0 am with the playing of the "Good Night Melody" which was also used from the old ZCKW. Try for this one on a good morning as it will be a new country for most listeners.

RADIO PAKISTAN. — Some listeners may have already heard one of the few amateur stations in this country, but if you have not, try for the new station, Radio Pakistan which has commenced operations on 6.06 mc. This new one can be heard from before midnight when the usual type of Indian music is broadcast. At 12.30 am, we have heard a talk in English, and this seems to be given by an American as the accent is not the typical English one common to All India Radio stations. At 1.30 am another talk in English has been heard or it may have been a news session, but strength was very low at this time, and beyond the fact of recognising the language as English, very little could be understood. We hope to have further information about this station for our next issue, as it is possible they are also using other frequencies in addition to 6.06 mc.

RECEPTION FROM ALL CONTINENTS

WHILE the majority of short-wave listeners seem to be interested in logging as many stations as possible with a view to obtaining the station verification card, there are others who prefer to listen to the higher powered transmitters who put in a consistently good signal of entertainment value. While the writer has always been especially interested in logging all new stations as they come on the air, the "easy to log" stations are not neglected, and many hours are spent each week listening to one or other of the USA or BBC stations with the sole desire of enjoying the programme.

In this short article we will list a few stations from each continent, which will be audible on any short-wave receiver.

NORTH AMERICA. — At all hours of the day or night there is at least one of the Voice of the United States of America or the Armed Forces Radio Service stations audible at good strength. The best outlets at night are KNBA on 9.65 mc and KNBI on 9.75 mc for the V. of A. programmes, and some excellent programmes can be heard between 7.30 pm. and 8.15 pm, and if you then change over to KWID on 11.9 mc, another 45 minutes of music can be heard until the news at 9.0 pm. In addition to KWID on 11.9 mc, KGEI on 9.53 mc opens at 8.45 pm, and carries the same programme. During the afternoon and early evening there are quite a number of other good outlets in the 19 and 25 metre bands.

EUROPE. — Pride of place in the European stations must be given to the many BBC transmitters especially those beamed to Australia and New Zealand from 4.0 pm to 5.45 pm. The stations used in this session are GRX 9.69 mc, GSN, 11.81 mc, and GSF, 15.14 mc, while GVZ, on 9.64 mc is equal in strength on most days. The Swiss stations are also very reliable, and can be logged daily except Sunday and Wednesday from 5.15 pm to 6.45 pm over HE15, 11.715 mc, HER5, 11.865 mc, and HER7, 17.784 mc. Paris is excellent in the mornings on 9.68 mc, and also around 4.0 pm on 9.55 mc, while Madrid puts in a very good signal at 6.30 am on 9.37 mc. The German station in Leipzig which operates on 9.72 mc, is another good one in the afternoons.

AFRICA. — The African stations are always more difficult to hear than those from other continents, but at the present time we have OTC2 in the Belgian Congo coming in nicely daily around 6.30 am on 9.676 mc, while Leopoldville over FZI reaches reasonable strength, with its 11.97 mc outlet, and is also quite understandable with the news in English at 6.45 am on 6.02 mc, and sometimes also on 7 mc. FZI on 11.97 mc can also be logged in the afternoon around 4.0 pm. If you care to get up in the very early hours of the morning, you can hear VQ7LO, Nairobi on 4.855 mc, and also the Lourenco Marques station on 4.93 mc with their special programme for South African listeners.

SOUTH AND CENTRAL AMERICA. — Still the loudest Latin American station is HI2T, in Ciudad Trujillo, Dominican Republic on 9.727 mc, when it comes on the air at 9.0 pm. Another station in the same country, HIIZ on 6.11 mc is usually quite good at 9.30 pm, while the well-known CE622 in Santiago, Chile on 6.22 mc is always good at the same time, closely followed these nights by HJEX in Cali, Colombia on 6.055 mc. In the late afternoons, the Mexicans excel and best of these are XEWW on 9.5 mc, and XEBT on 9.625 mc, until closing at 4.0 pm, with the playing of "Happy Birthday." The well-known Quito stations HCJB can be heard both in the early afternoon, and at night on 9.958 mc, 12.455 mc, and 15.115 mc.

ASIA. — From this continent we have a large selection of stations and at night especially quite a number of countries can be logged, such as Radio Saigon on 6.17 mc, KZRH, Manila on 9.64 mc, KZRC, Manila on 6.14mc, to mention two of the Philippine stations. In addition there are quite a number of the All India Radio stations on the air among the best of which are VUD10 on 17.83 mc, which has an excellent musical programme at 9.45 pm. The Indonesian stations are numerous and come in at varying strength at different locations, but the loudest at our listening post is YDC on 15.15 mc, and on Sunday night there is a fine dance orchestra programme around 9.15. Last but not least is SEAC, both in the 16 and 19 metre band, which comes in quite nicely.

THIS MONTH'S VERIFICATIONS

ROT-WEISS-ROT, Austria. — A card which was well worth waiting for was one recently received from the Austrian station Rot-Weiss-Rot located in Vienna, and which transmits on 9.565 mc. The card is printed in red, white, green and pale blue, and at the top is headed Officila verification of Reception, then the call letters OE-RWR beneath, together with the location and power, 800 watts. The main design of the card is a map of Austria with large green radio towers rising from Vienna, Linz, and Salzbury. The card is signed by the station manager, and in addition a rubber stamp is impressed alongside the signature. Across the top of the card is also shown the first few bars of the "Blue Danube" waltz.

BERLIN, GERMANY. — We have recently received quite a long letter from Berliner-Rundfunk verifying our reception of their Berlin station which operates on 6.07 mc with a power of 5 kw. Unfortunately the entire letter is in German, and although the fact that our report was verified can be gathered from the few words which we understood, there were quite a number of other words which overwhelmed us such as "Ausbreitungsbedingungen" and "Empfangsbeobachtungen." This station is in the Russian controlled zone, and it also has an outlet on 191 kc with a power of 120 kw. The station address if you want to send them a report is, Berliner-Rundfunk, Masurenallee 8, Berlin-Charlottenburg 9, Germany.

MUNICH, GERMANY. — Arthur Cushen has received a very nice verification card from "Radio Munchen" confirming his reception of their station on 6.08 mc. They send out an attractive colored card showing a view of the Alps, and the towers of Munich against a yellow grey sky. A large QSL is across the card and then "Radio Munchen" in black. Another verification that has received from Germany is from "Radio Stuttgart" which took the form of a letter in English in which they state that at the time of his reception they were using 900 watts. In March, 1948, the power was increased to 9 kw, and in May, 1948, a horizontal centre fed antenna was added. They now operate on 6.18 mc, from 7.30 pm to 10.30 pm and 2.0 am to 7.30 am.

YV3RN, VENEZUELA. — Our very active Brisbane listener, Mr. Ern Moore has sent down for our inspection a verification he has received from YV3RN, Radio Barquisimeto, Venezuela. Readers will remember we reported this station in the July issue as being heard by Mr. Moore. The verification is in the form of a letter from the station manager, Mr. R. A. Segura, and though it is all in Spanish, the fact that the report is verified can be understood all right. At the top of the letter they show their short waves, call YV3RN 4.94 mc, and broadcast band call YV3RE 1475 kc. The address is Evenida Bellavista 461, or Anartado Postal 76, Barquisimeto. Other readers can now look forward to receiving their verifications before very long.

VLT5-VLT7, PAPUA. — We have just received our verification cards from VLT5 and VLT7, Port Moresby. They are the usual P.M.G. type black and white with the particular call and frequency shown at foot with a rubber stamp. The power of these stations is 2 kw in aerial, and the schedule is VLT5 7.28 mc, Sunday 7.45 am to 11.0 am, 6.15 pm to 10.0 pm Mon. to Fri., 6.45 am to 8.45 am, 6.15 pm to 10.45 pm, Saturday, 6.45 am to 8.30 am, 6.15 pm to 11.0 pm, VLT7, 9.52 mc, Sunday noon to 2.0 pm, 4.0 pm to 6.0 pm, Mon. to Fri., noon to 1.45 pm, 4.0 pm to 6.0 pm, Saturday noon to 6.0 pm. The Superintending Engineer states that no changes in frequency or additional frequencies are contemplated for VLT at the present time.

FLASHES FROM EVERYWHERE

POLAND. — Readers will remember that a few months ago we reported a new Polish station which was heard in the afternoons at very good strength transmitting on 9.53 mc. In company with quite a number of other listeners we reported this station to "Polskie Radio" and strange to say they do not seem to know anything about it, and disclaim it as one of their stations. In a recent letter from the station, they say, "We have had already from Australia reports concerning these test relays, it is possible you heard the test relay. No other station seems to be in view. It is rather difficult to inform you if you have heard our Polish Station." The above is all a trifle difficult to follow, and perhaps other listener's letters have been more enlightening.

GREECE. — Radio Athens appears to have made a further change in their transmissions, according to the latest advise we heard through Radio Australia's DX session. They are now transmitting on 9.605 mc relaying the Home Service programme. This frequency is used in place of 6.175 mc, which was previously used for some time. They come on the air at 3.0 pm and conduct a test until 3.12 pm and then the programme commences at 3.14 pm with the playing of the Greek National Anthem. News in Greek is given at 3.15 pm, a musical programme from 3.30 pm till 4.0 pm, and on Sundays only a Church service from 4.0 pm till around 4.30 pm. We have had no reports on this 9.605 mc outlet as yet.

HOLLAND. — Radio Nederland have just sent us their latest schedule of transmissions which are as follows.—8.0 pm to 8.40 pm in English on 6.02 mc, 15.22 mc, 17.775 mc, and 21.48 mc directed to Pacific area and Europe; 3.30 am to 4.10 am on 6.02 mc, 9.59 mc, and 11.73 mc directed to Great Britain, South Africa, and Europe; 12.30 pm to 1.10 pm on 6.02 mc, 9.59 mc, and 11.73 mc directed to the United States, Canada and Australia; 8.30 am to 9.10 am on 6.02 mc, 9.59 mc and 11.73 mc directed to South America and Spain, and on the same frequencies between noon and 12.20 pm, a programme is provided for Central America and the Northern portion of South America. On Tuesdays there is a special programme for Australia and NZ, from 6.30 pm to 8.0 pm in the 13, 16, 19, and 49 metre bands.

MAURITIUS. — We are indebted to the Swedish DX Bulletin for details of a new station operating on the island of Mauritius. This newcomer which has the call letters VQ3USE is operated by the Mauritius Broadcasting Company and is stated to be operating on 7.295 mc, with programmes in French. The actual operating times are not known at present, but on the medium wave channel they usually operate from 1.0 pm to 1.45 pm, 6.15 pm to 6.50 pm, and 1.0 am to 3.30 am. Although the short wave outlet is supposed to be 7.295 mc, a Swedish listener has reported reception of this new station on 7.143 mc between 1.0 pm and 2.15 pm, so it would be as well to keep a watch on both frequencies.

BRAZIL. — According to Arne Skoog of the Swedish Broadcasting Organisation a new station known as "Radio Journal do Commercio," is operating from Pernambuco. Four different frequencies have been used and the first one, ZYK2 is on 15.145 mc, and has been heard in New Zealand at 9.50 pm. Another outlet, ZYK3 comes into operation at 5.0 am on a frequency of 9.565 mc and remains on the air until noon. Tests have also been carried out on 6.082 mc, and they also have a fourth channel, 11.825 mc, but at the present time no information is available about these latter two outlets. We should imagine that ZYK3 would be the best bet for Australian listeners around noon or ZYK2 at 6.0 am.

NEW STATION LOGGINGS

Call	KC	Metres	Location	Time Heard
KZMB	6000	50.00	Manila, Philippine Is.	10.00 pm
Radio Pakistan	6060	49.50	Karachi, Pakistan	12.30 am
Radio France	6190	48.47	Hanoi, French Indo China	9.30 pm
YNQ	6950	43.17	Managua, Nicaragua	10.15 pm
Forces Station	7220	41.55	Cyprus	5.30 am
N.W.D.R.	7290	41.15	Hamburg, Germany	6.30 am
YCN3	8090	37.08	Balikpapan, Borneo	10.00 pm
YNXW	8170	36.72	Managua, Nicaragua	10.15 pm
Dakar	11900	25.21	Dakar, Senegal	6.00 am
WRA9	13470	22.27	Tangier, Tangier	4.15 pm
CS2MQ	15100	19.87	Lisbon, Portugal	7.00 am
XGOA	15105	19.86	Nanking, China	7.00 pm
ZYC9	15370	19.52	Rio de Janeiro, Brazil	9.00 pm
WRA4	15950	18.81	Tangier, Tangier	4.30 pm
WRA17	18695	16.04	Tangier, Tangier	4.30 pm

NEW STATIONS OF THE MONTH

TANGIER. — During the past few weeks the United Nations Radio Division has been using three stations in Tangier to broadcast special programmes for various European countries. These stations are WRA4 on 15.95 mc, WRA9 on 13.47 mc, and WRA17 on 18.695 mc. The first one, WRA4 has been heard from just after 4.0 pm, when they broadcast a special programme for Radio Warsaw, while WRA9 on other days has been heard at the same time with programmes for Radio Brussels and Radio Luxemburg. On one day, just before we were listening to WRA4, we logged WRA17 with a musical and news programme for Radio Belgrade and Radio Prague. In each case listed above, the same programme was heard on 10.61 mc, but no call letters were mentioned.

PORTUGAL. — The National stations in Lisbon are now showing some activity in regard to new frequencies and we have logged CS2MQ, when it comes on the air at 7.0 am on 15.1 mc in parallel with CS2MK on 11.027 mc. Another of their stations, CS2MT on 15.32 mc is supposed to come on the air at 12.30 am, but so far we have not been able to hear it. It is interesting to note that CS2MA on 6.374 mc has either moved to 6.36 mc or has been replaced by another station on that frequency. The latter is probably the case as a few weeks ago, we were hearing both the stations at the same time until finally the 6.374 mc channel was dropped. The weakest of the above stations is CS2MQ, but by careful listening it can be logged

PHILIPPINES. — Our Northern neighbors seem to be rapidly increasing their activities on the short wave bands and by overseas reports there are still more new stations contemplated in the future. The latest addition on the higher frequencies is KZMB, which we have been hearing for the past few weeks transmitting on 6 mc. Strength varies and on some nights morse is troublesome, but toward midnight it improves. This station is operated by the Manila Broadcasting Co., and they announce as "This is MBC the Manila Broadcasting Co., station KZMB the Voice of Manila." Incidentally this new one does not carry the same programme as KZRH which is operated by the same company as KZMB.

SENEGAL. Our good friend Art Cushen was the first to bring to our notice that Dakar is now operating on a new frequency of 11.89? mc. No difficulty was experienced in logging this African from around 6.0 am, when musical numbers are in progress. At 6.15 am they begin a news session in French with alternate items given by a lady and gentleman. Just prior to the news, one stroke is given on a gong followed by announcement "Ici Radio Dakar," and at the conclusion of the news the location can again be heard. On some mornings this new station can be heard till as late as 7.30 am, though by that time the strength has dropped quite a lot from what it is at 6.0 am.

CHINA. The Central Broadcasting Administration in Nanking are now experimenting with still another new outlet for their programmes in addition to the two new stations XGRY and XGRZ previously mentioned. At 7.0 pm you can now hear the XGOA programmes on a new frequency of 15.105 mc, when news in english is broadcast. At the conclusion of the news they announce as XGOA on 15.105 mc, 5.985 mc, 9.73 mc and on the first night we heard them they asked for reception reports on the first mentioned frequency. Quality of this station, as is the case with most Chinese, is very poor with a peculiar fluttering effect which tends to spoil the speech and make it sometimes practically unintelligible.

BRAZIL. — It is sometime now since we logged any new Brazilian station and we were therefore very pleased to hear a new one in the case of ZYC9 on the rather unusual frequency of 15.37 mc.

SHORT Wave Notes for the November issue are due on October 9th. In the December issue they are due on November 12. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, NSW.

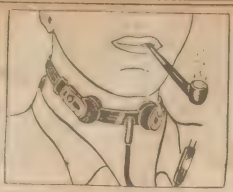
SCHEDULES OF WWV

USA. — Station WWV which is operated by the Bureau of Standards is a very useful station both for time signals, and as a means of calibrating your receiver. At present they operate as follows:—

MC	POWER. (kw)	MODULATION (cps)
2.5	0.7	440
5	8.0	440
10	9.0	440 & 4000
15	9.0	440 & 4000
20	8.5	440 & 4000
25	0.1	440 & 4000
30	0.1	440
35	0.1	None.

The above stations are now on the air continuously day and night and further information can be obtained from The National Bureau of Standards, Washington 25, D.C., U.S.A.

IRAN — In the latest copy of the Universalite we learn the latest schedule of the Teheran stations in Iran operated by The Wireless Dept., Ministry of Posts and Telegraphs. The call letters, frequencies and operating times are as follows: —EQA, 895 kc, EQB 6.15 mc, EQC 9.68 mc, EQD, 4.79 mc, and EPB, 15.1 mc, Schedule is EQA, EQB, EQD, noon to 1.30 in summer; 12.45 pm to 3.0 pm in winter. EQA, EQC, 8.45 pm to 10.30 pm; EPB 8.15 pm to 10.30 pm; EQA, EQB, EQD, 1.0 am to 6.0 am, in summer, midnight to 5.0 am in winter. News in English is given at 10.15 pm, and news in English or French is also heard at 1.45 am. The above information should enable listeners to log one or other of these stations.



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for noise elimination in Cars, Motors, and all Electrical interference with mounting lug and wire.
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New contain excellent generator and brass gears. In aluminium case. Weight 1lb.
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All Wave using Plug-in Coils. Uses two 45 Volt and one 1½ Volt dry battery—

4 Valves — Types 1P5, 1D8G, 1J6G—

By purchasing a Reinartz Coil and placing in Aerial Socket in Set all Broadcasting Stations can be brought in—for other bands we can supply Coil Formers, 2/6 each.

The Set is equipped with 2 Coil Formers but No Valves — Price with 2 Coils, £3 F.O.R.

The Original AR14 Army Packing Case, Wood Metal bound, can be supplied for 3/6 extra.

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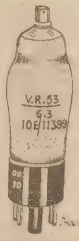

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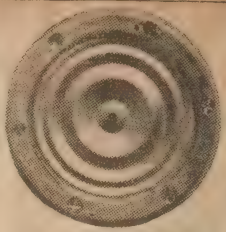

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Motor Car. Pyrox SPARK PLUG NOISE SUPPESSORS.
EACH ..... 9d.
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With 50 mfd copper oxide rectifier relay, 3.8v. lamp and socket, 2 phone jacks.
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Fits neatly into the lid of the Calstan 223A Multi-tester and most other Valve Testers.

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including chart of valve types and settings.

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THE HAM BANDS WITH BILL MOORE

It is interesting to review the varied aspects of current discussions on phone and CW allocations, be they by regulation or by domestic agreement. A wide diversity of opinion exists on the subject and we see extreme views on both sides.

SOME go to the extent of demanding no phone, others no CW. It is to the larger and middle section we must look for a logical approach to the problem.

There seems to be several ways to weigh up the subject, but, firstly, one must decide the amount of spectrum to be made available to either form of transmission. The relative activity of stations using both forms of transmission is of major import and, should phone stations be granted more space by comparison because of the inherent factor of their transmissions taking up more space?

It is a difficult task to obtain any accurate estimate of activity except by observation. Polls to a large degree are useless, as only about 20 per cent replies can be anticipated, and whether this return would be a true cross-section is a matter for conjecture.

From a more or less casual observation one could weigh up the position band by band as follows: 28mc predominantly phone, 14mc predominantly CW (some might not agree), 7mc phone and 3.5mc phone. The observations above are in terms of activity only. Another problem thus arises, namely, that no set ratio phone-to-CW could be fixed, but would have to be varied band by band.

Subdivisions in the USA run approximately 25 per cent phone to 75 per cent CW on most of the bands. We have to consider also the fact, if all national societies decided to apply for subdivisions in their own country, we would have that many divisions that we wouldn't recognise our bands. The RSGB idea of subdivisions on a continental basis may be a solution to that problem.

The general international understanding that keeps the low end of 14mc clear of telephony stations is working out well in practice, and some similar scheme might be applied to the 3.5, 7, 21 and 28 mc bands. The much-maligned "gentleman's agreement," or call it what you will, is, in fact, working fairly well on 14mc. We will always have the difficult few who will not follow the workings of the multitude but, with a good publicity programme, there seems some hope for a compromise to keep both phone and CW stations in their own little areas.

REMEMBRANCE DAY CONTEST

THE WIA's first annual Remembrance Day contest was easily the best supported interstate contest in amateur history. All States provided sufficient entrants to make the test worthwhile and interesting.

A rough check during the first two hours of the contest showed over 70 stations active, while, during the whole 24 hours, well over 100 stations took part.

All States should have six high scoring stations and it will be interesting to see when the results are published in Amateur Radio which State division wins the coveted R/D trophy.

As the scoring was on a sliding scale, the final results are a matter for conjecture at this stage. Stations that used a combination of both telephony and CW seemed to score well.

On the highlights: There was the NSW amateur who prided himself on the quality of his telephony—and rightly so, too—he was heard going well on the Saturday evening, heard later on Sunday morning his telephony sounded shocking—not the transmitter, just his voice; it had been reduced to a mere croak. High scorers in NSW should include VK2AHA 2RA, 2PA, 2ZH, 2VN, 2QL, 2JX, 2ZC 2CI, 2DO and 2EO.

A few minutes before the contest closed old ex-5NR opened up as VK9NR on Norfolk Island, and 2PA was the lucky one to hook him and it is believed that contact was enough to place Peter ahead of other NSW contestants. Federal secretary Bill Mitchell, VK3UM, took off enough time from his WIA duties to build up a nice score. The VK7's and VK6's combined nicely in their respective States to build up good divisional scores.

The contest provided an opportunity for many interstate amateurs to make acquaintances again, and the support was pleasing, seeing it was a contest to perpetuate the memory of amateurs who passed on in the 1939-45 World War.

AUSTRALIAN VISITOR

IF amateur radio ever needs an ambassador to present its case to any authority, we should call on Bob Black ZL2BX, a recent visitor to Sydney.

Although active since 1924, Bob is an enthusiastic ham as ever and endeavors at every turn to extol the virtues of amateur radio as a hobby. Before leaving Wellington he dug deep into his box of QSL cards to renew old acquaintances while in Australia. The cards themselves are quite interesting, and included A3AM, 3ZN, A3TM, OA3AX, A2YI, 2CM, 3HH, A3HL, A2GW, A3VP, 2DS, 2ZN, 2BV, 2OB, 2HZ, 2PM and OA2RF. Some of them have passed on to the spot where the hill rotates, but many are still as active as ever.

> WE heard with deep regret that K. B. Warner (WIEH) A.R.R.L. secretary and QST Editor, died from heart failure on September 3. His work for amateur radio was invaluable and untiring. The League's success is a monument to his organisation. His name, with others such as Hiram Maxim and Ross Hull will become legendary among amateurs of the world.

ZL2BX's remarks on conditions and comparisons between the two Dominions are very enlightening. Having listened in many spots here in VK, he considers NZ, from a DX viewpoint, has the edge on Australia. Many VK's have found that out to their embarrassment when trying to compete with the ZL's for the choicer DX.

He considers also that signals on the higher frequency bands in NZ are of better quality than those here, attributing it to the fact that ZL stations must serve a probationary period of 12 months on 80mx before being granted a HF permit. All initial experimenting is done on 80 before migration to the 20 and 10-metre bands.

Bob would like to thank all Australian amateurs for the hospitality shown him here and assures any VK the same welcome in Wellington, NZ.

W.I.A. APPOINTMENTS IN N.S.W.

LEE CUFFE, VK2AM, is a new Divisional Councillor, taking over from Arthur Thurston, VK2AV, who resigned Arthur's prolonged travelling forced his resignation. Dick Dowe, VK2RP, and Vic Cole, VK2VL, have been appointed Assistant Treasurer and Assistant Secretary respectively.

To cover the city area for notes for Amateur Radio, in a similar manner to the country zones, zone officers have been appointed. Officers and areas covered are as follows: North Shore VK2AM, Southern Suburbs VK2VW, Eastern Suburbs VK2AX, St. George VK2ALG. VK2ACX will write the DX notes, and VK2NP covers UHF activity. The new arrangement gives State-wide coverage.

Q.S.L's.

WE hear from all and sundry complaints that few QSL's are exchanged these days. Whether one QSL's or not is entirely a matter for the individual and depends on his point of view, but it seems a pity that the courtesy of a QSL as a final gesture to complete the contact is dropping out.

A card out for every one received on the surface has its points. It is quite simple to see, if everyone adopted the same attitude, no cards would be exchanged.

To the chap with the big collection it is probably an easy way out; but what about the newcomer? Are you gracious enough to take the initiative, and not sit back on your laurels? Not too many years ago we exchanged cards for contacts over the back fence, and were proud to do so. All newcomers get a thrill out of their first lot of cards. Remember your first DX card—don't say you were not proud of it! It is up to all of us to see that old QSL-ing habit does not fall out of favor.

Admittedly, it's a fairly expensive game these days; printing costs are well up, but, written against what one spends on gear, it is generally only a small percentage. Don't be too despondent if your DX cards are long in arriving. Mails are slow these days, and via the Bureau even slower. Here is to a revival of the QSL habit.

W.I.A.'s. GROWTH

ALL WIA workers and amateurs generally are gratified to see the rapid growth in membership postwar. Most divisions have doubled their prewar membership and some have trebled it. Responsible for the increase is the valuable work done by the executives on a voluntary basis.

The WIA has one aim, and that is to represent as fully and effectively as possible the Australian amateur. The organisation centres Federally around a Federal executive, at the moment located in Melbourne. Federal councillors elected by each State meet annually at the Federal convention and, under directions from their State, formulate policy from an international and nationwide viewpoint.

State divisional councils are elected annually to administer and co-ordinate the varied State activity. This includes the running of AOCP classes for intending amateurs, lectures for meetings, QSI bureau, zone activity, field days, State and country conventions, and the other aspects that go up to make a successful division. In Victoria they have the additional task of publishing Amateur Radio.

The WIA undoubtedly has a job to do, and a strong Institute, strong in membership, can best represent you as an amateur. If you are not a member, give it a thought and join to assist the WIA to help you.

288mc FIELD DAY

THE Gladesville Radio Club staged on August 29 the first 288mc field day. Four stations signing VK2ADY were sent

out by the club. They were located near Hornsby and operated by VK2HL and 2NK. Bringelly, with 2AMG, at Galston with 2AZU and 2AGB, and at National Park were 2CR, 2NP, 2AEX and 2AZ. Others out in the field included VK2KI near Bankstown, 2PL at Kurrajong, and 2YE, West Pennant Hills. The equipment generally used were 6J6 long-line oscillators and three to five element beams horizontally polarised, plus super regenerative receivers. Contact was made between all club stations. Further afield were 2LZ and 2FI, at Wentworth Falls, and active from their home QTH were 2ND, 2ABZ, 2ALU and 2FK.

The day clearly demonstrated the uses of simple gear at this frequency and, when half a wavelength is only 18 inches and long lines three inches, gear can readily be kept to portable limits.

W.I.A. NEWS

THE biggest attendance on record attended the August meeting of the NSW Division to hear a lecture by Angus Robertson, of the Department of Civil Aviation, on "Frequency Modulation." It proved to be one of the finest yet delivered.

Visitors at the meeting included Federal WIA secretary Bill Mitchell, VK3UM and G3UX. The Federal secretary spoke at length on Federal matters and, as usual, received the barrage of questions.

Certificates for the WIA DXCC and won in previous contests were presented to VK2EO, 2QL and 2WD.

A letter read from VK2VE complained of the poor returns for QSL cards sent out and quoted one W7 who for 37 contacts with VK stations had received no replies. Wal Ryan, VK2TI, suggested that the Remembrance Day contest be extended to include New Zealand amateurs, and that the transtasman contest be discontinued.

A constitution sub-committee has been set up to re-draft the present NSW constitution to comply with the present Federal policy and also to include a new section to cover the proposed establishment of sub-branches of the division in country centres. The committee comprises J. Moyle, VK2JU, R. Dowe, VK2RP, and W. Moore, VK2HZ.

Scheduled for the November meeting of NSW Division is a lecture and demonstration on Frequency Modulation by Eric Fanker. The lecture will be followed by films and a display of FM equipment Date, November 26, at Science House.

THE STORY OF HENRY JONES
Young Henry was wiser than they thought. He was wise to his future and in his spare time became a
REFRIGERATION SERVICE EXPERT
ELECTRICITY · GAS · KEROSENE
GOSH! THE REFRIGERATOR HAS BROKEN DOWN, ALL THAT WEEK-END FOOD TOO - WHAT ON EARTH SHALL WE-
ITS FOR HENRY JONES, AT HIS HOME.
WHAT! THAT YOUNG HENRY JONES?
DIDN'T YOU KNOW? HE'S A QUALIFIED REFRIGERATION SERVICE EXPERT NOW
HE LEARNED BY MAIL AND MAKES LOTS OF MONEY IN HIS SPARE TIME ALREADY.
WELL I NEVER. GIVE HIM A RING RIGHT NOW-
EVERYTHING'S O.K., NOW MRS BROWN
OH! THAT'S WONDERFUL
The story of "Henry Jones" may be your story, and his future of independent prosperity may well be yours, too. Modern Refrigeration Service, Electricity, Gas, Kerosene, opens up a wonderful field for young men of average education who wish to make good money in an uncrowded occupation . . .
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COMMERCIAL INTERFERENCE

THE regular appearance of one Radio Teletype station on 14,030kc each evening brings to mind the problems of commercial interference in our bands; they are narrow enough without the advent of poor commercial signals to help the QRM problem.

If we ourselves take no action to have these stations removed, no one else will worry. We should log the station in question and note times of operation and frequency and any useful information, and forward it through the WIA Divisional Council, who will forward the information to the Federal authorities, who can then take up the matter with the PMG. We must take the initiative ourselves.

G3BQC

G3BQC is the call-sign of W. H. Plant, who was stationed at RAF 'drome, Bardney, Lincolnshire, during World War II. He is particularly anxious to link up with his old RAAF pals of the W/Ops Section, No. 9 Lancaster Bomber Squadron. If you cannot contact him on the air, his home QTH is 19 St. Laurence Ave., Warick, Warrs., England.

THE U.H.F's.

THE aurora helped UHF propagation along during August, and VK2FI, in Wentworth Falls, Blue Mountains, range was extended into Newcastle. For two hours his signals were heard by VK2BZ and 2AGD. Under normal conditions his signals are not received in the coal city. These happenings were on the 144mc band. VK2TY Lochinvar, VK2ADX Maitland, and VK2ADT Cessnock are working together. In the Newcastle and coalfields area some stations are using super regenerative receivers and some superhets., and the general opinion is to the effect that the superhet. is up four strength points on the super regen.

The NSW WIA's UHF section's contest should help to foster further interest in the UHF's. Rules briefly are as follows:—

Commences 0001 hrs. 1st October and concludes 2359 hrs. 31st December. Contest exchanges consist of normal contacts which may not be repeated with the same station on the same band under 24 hours. Bands for operation include 50, 144 and 288 mcs. The points score is arranged on a distance basis, the farther away the contact the greater the score obtained.

Fixed, portable or mobile operation is permitted under one call and the score combined and entered as one log. Cross-band operation is allowed for scoring purposes, the station claiming for the band he is transmitting on. Suitably-inscribed trophies will be presented by the NSW Division for the best total combined bands score and also for individual band scores.

GET YOUR TICKET !

And join the ranks of licensed amateur transmitters. The W.I.A. holds regular classes in theory, practical work, and code. Fully qualified instructors.

Write for particulars to the Amateur's official organisation.

THE WIRELESS INSTITUTE OF AUSTRALIA,
Class Manager, Box 1734, GPO, Sydney.

THE SERVICEMAN WHO TELLS

(Continued from Page 45)

"Cockroaches in a mantel set brought from a canteen once overwhelmed me. As I took the chassis out they rushed out in all directions and, for weeks after, I always had something at hand to deal with survivors.

"I was not a bit thrilled over the research into tropic-proofing radio equipment for Island use. I could have saved them lots of time by telling them to store the equipment in fish and chip shops for three or four months. I have had to use wood chisels, &c., to get the fat off.

"It has been often said that commonsense goes a long way in solving elementary troubles, but for sheer lack of it I must return to an incident which happened years ago. I had done a service job, and the customer asked me if I would look at a set further up the street (it happens many a time). On calling at the house I was informed that the set had not been in operation for over three months (this was depression days), and cost was of prime importance. Would I look and quote?

PLUG CONNECTION

"I pushed the three-pin plug in and switched on. There was not a sign of life in the set anywhere, so I examined plug and found one wire going to the earth pin of plug. I inquired whether they used the iron on the same holder. The iron cord was brought, and it was wired in the normal way, but no lead to the earth pin. On examining the holder on the board, I found it was not wired for earth, anyway. The three-pin plug on the iron cord had been connected by the person who installed the board and point. The tenants had changed the radio connection from the bayonet adaptor to the three-pin plug. The set was in perfect condition, valves showing good emission. Wouldn't it?

"During the depression I had occasion to service a set at the house of two old aged pensioners, who were both confined to the house through sickness. There were two chairs, one on each side of the radio, demonstrating the fact that they looked to the radio to bring them the news and entertainment from the outside world. The 80 had done its dash. I suddenly thought about the 80's in the workshop that had still some useful life left, but replaced at the request of valve conscious clients. The set was put into operation again with all the "bless you's" from the old couple at no charge. They both passed on within 12 months.

"I have made it a practice ever since of putting on one side all valves with any useful emission left in them.

"A serviceman sees family life and conditions even more intimately than doctor or clergyman, for whom the room gets a 'once over" and the children hushed or sent outside to play. There is natural conversation, and any serviceman who does not drink tea (I average six sessions each day), cannot to my way of thinking be popular.

"There are many funny and peculiar service jobs one could dig out of the past, but the one that stands out from all the others, is a job I was called to in the suburbs. I stood at the gate, the front door was open, and a nasty-looking cattle dog was barking its head off at me. I was determined not to make a forward move until someone made an appearance. I was much relieved on seeing the owner of the dog arrive to quieten it. "Come on in, it won't bite." (I've heard that hundreds of times.)

SOME CARPET!

"Going through the front door, I heard a queer rustling sound, and looked behind. Yes, it was a snake, 10 feet of the carpet variety. Down the long hall my feet did not touch the floor once. I was offered and drank a glass of water, and with the snake on one side and the dog on the others, I replaced a .1 condenser in the screen circuit.

The man of the house had some collection—stuffed birds and animals all over the house, and tanks of fish in the yard. I collected my fee, and was given a snakeskin card-holder also. I was told by neighbors that his spouse had left six months before, and I can hardly blame her."

"Well, thanks for your letter, Mr. Kay. I have replaced many condensers in my time, but never with a 10ft. serpent as a bystander. On second thoughts, "bystander" is hardly the correct word to apply to a snake.

Just to round things off the 0.1 mfd. condensers one finds on B-plus, screens and oscillator plate, are regular contributors to the income of radioservicemen. Next to electrolytics, they are possibly the most frequent cause of breakdown, particularly in old sets The danger period is immediately after the set is switched on, and before the valves begin to draw current from the power supply.

PEAK VOLTAGE

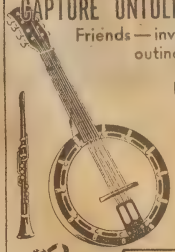
During this initial period, the high tension voltage is likely to reach between 400 and 500 volts, even after the field coil.

Since there is no drain through the various dropping resistors, the same high voltage is present across the screen and oscillator anode bypasses and, for a brief period, their voltage rating is exceeded .Good condensers will stand this quite readily, but it finds out those with any internal weakness.

The moral is never to use anything less than 400-volt condensers on any portion of the high tension circuit of a receiver, whether it be the main H.T. line or a screen circuit, the oscillator anode supply, or a decoupling network. If you can manage 600-volt condensers, so much the better, but avoid 200-volt types like a plague, unless you know for sure that the peak voltage will never exceed this figure.

CAPTURE UNTOLD PLEASURE

Friends — invitations — outings!



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- Beginners start playing in 30 minutes.

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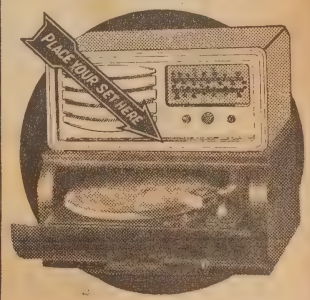

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OFF THE RECORD — NEWS & REVIEWS

It is quite some time since we had a really important release of a String Quartet. This month includes a performance of Beethoven's Opus 132, one of the landmarks in string music.

By JOHN MOYLE

QUARTET No. 15 IN A MINOR (opus 132) (Beethoven), played by the BUDAPEST STRING QUARTET COLUMBIA LOX-673.

The musical value of this performance would commend it apart from anything else. The Budapest has always been one of the finest recording — personally, I'd as soon hear their work as that of any other. They have a character all of their own—maybe not as brilliant as the Lener, but musicianship and sensitivity is always there.

There is a shallowness about the recording which makes me suspect it is not a very recent one. One soon gets used to it, however, the overall effect being more that of a small hall than a room. Moreover, a quartet is a rather dangerous thing to record too closely—its dynamic range can be disconcerting to the engineer. Here and there the reproduction gets a little ragged, but only here and there.

There is some of Beethoven's greatest music in his quartets, and in this famous example, we have one of his greatest. It is a fascinating study to compare it and its immediate companions with some of the earlier quartets, realising in the process how far Beethoven had progressed in the art of making really significant music. There is none of a mere stringing together of melodies and ingenious development. The amazing skill and interplay are merely means by which the four voices, singly and together, unfold an unforgettable experience in which one's complete emotional and intellectual resources are touched. As with all great music, this quartet adds to experience so that one is not quite the same again. So much has been written on this point that it is idle to add to it. Let the Budapest tell you instead. Musically, these are records of the month.

NIGHTS IN THE GARDENS OF SPAIN (de Falla), played by CLIFFORD CURZON (piano) and the NATIONAL SYMPHONY ORCHESTRA conducted by ENRIQUE JORDA, Decca Z914-6.

This is well known music, very easy to hear, and of course, programmatic in its nature. It makes huge demands on the pianist, particularly in the final section with its famous octave passages so beloved by the virtuosi.

The performance is a good one in almost every respect, although the recording is not as clean in places as I would have liked. It is in fact, a fellow recording to the Marche Slav, and as a result its general characteristics are much the same. It should play well enough on the average equipment.

MARCHE SLAV, OPUS 31 (Tchaikowsky) played by the NATIONAL SYMPHONY ORCHESTRA conducted by ANATOLE FISTOULARI. Decca Z913.

This is one of Tchaikowsky's best known show pieces, brilliant, colorful and weighty. The performance is all these things, and in addition, has an excellent frequency range. It will, however, tax the resources of your equipment, and will require a good needle point to stand the gaff. Despite the extended range, I found it necessary to cut out the tweeter to avoid some "tearing" on the extreme top, probably due to pressing. In other words, it's a terrific recording, and nearly all such records require everything to be right to make the best of them.

SONATA No. 3 IN E MAJOR (Bach) played by YEHUDI and HEPZIBAH MENUHIN, HMV ED 827-8.

Both arists are well suited to music of this kind. Their appreciation of it is thoughtful and sound—their understanding intimate enough to produce a convincing performance. Of the two, Hepzibah is possibly the least compromising, but her role, although important, is secondary to that of the violinist. Of her outline and accuracy there can be little doubt, although she is not alone on this score.

The recording is a little remote—the cutting isn't particularly deep, and it gives an impression that the hiss level is a trifle higher than might be, although only the best grades of machines will probably notice it. In compensation, there appears to be no difficult passages, the whole set playing through quite cleanly. Menuhin's tone seems to be a little stronger than I have noticed in some records.

This is a good stock recording of Bach, and will please many.

RUSSIAN EASTER OVERTURE OP. 36 (Rimsky-Korsakov), played by the PHILADELPHIA SYMPHONY ORCHESTRA, conducted by EUGENE ORMANDY. Columbia LOX 670-1.

These records apparently were made at the same time as the Dvorak Symphony recently reviewed, for they are very similar in every respect. The recording chamber is not very resonant, but the definition of instruments is particularly good, especially the solo violin, which is heard on many occasions. The brass, too, has a most realistic edge to it, but once again I miss the full orchestral effect which really demands its share of reverberation for full development.

This is, of course, a show piece, with terrific contrasts of volume and color in which the full orchestra is called on again and again. Here, at least, there can be no room for disappointment. A word of praise, too, for the brass, which maintains its tone splendidly under pressure. This is particularly noticeable on the second and last sides, as, of course, we would expect from this orchestra. In fact the weight at such close quarters is at times almost overpowering. Overall range is good, with some impressive bass.

Terrific playing, if you can take it. The Philadelphia revels in this stuff.

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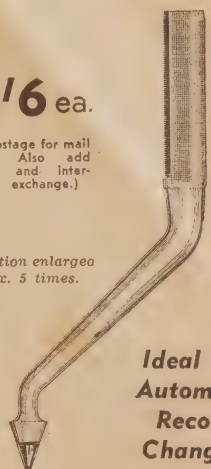

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ANSWERS TO CORRESPONDENTS

N.W. (Pymble, NSW) in writing in appreciation of the magazine, mentions of the success which he has had with a number of the circuits which have been featured. He also asks a few questions regarding the 4-valve "Handie-Talkie" and the "Little General."

A. We are pleased to note your success with those sets which you have built up from the circuits featured in R. and H., and imagine that the number of stations logged with the "Minivox" must have been quite heartening to you. Generally, 10 mfd. electrolytic capacitors are rated at 40 volts peak, with a working voltage of approximately 28 volts. Such a rating is inadequate for use in the circuit of the "Handie-Talkie," in place of the 8 mfd. condenser shown. This 8 mfd. condenser is bypassing the HT line where the voltage is 67.5 volts. The 6A8G may be used in lieu of the 6J8G in the circuit of the "Little General" without circuit alteration. We wish to thank you for your words of appreciation of and your good wishes to R. and H.

V.T.M. (Minnrooka, Qld.) would like to see a greater proportion of hobbies and articles of general interest in our magazine.

A. We appreciate your point of view, but at the moment we think that the balance between radio and other features of the paper is about the optimum. As you will appreciate, there are other magazines entirely devoted to hobbies, and the special appeal of ours lies in the radio interest.

N.T. (Stanthorpe, Qld.) reports having built the "Penatgrid Four" as a dual-wave receiver and has had good results from it.

A. Thanks for your report on the "Pentagrid Four," and we agree that it is an excellent little set. The 1C7-G is not a particularly good valve for short-wave reception, but you did the right thing in arranging for the oscillator anode resister to be shorted out on the short-wave bands. It is not satisfactory merely to connect a metal rectifier in a series with one of the leads to a d-c multimeter. This would give only half-wave rectification and the resultant reading would have little relationship to the a-c calibrations on the meter face. A further point is that a high current rectifier, 100 milliamps for example would operate very inefficiently in a low milliamp circuit, and the results would be poor as a consequence.

J.P. (Drawa, Vic.) wants to know how to tell the capacitance of a variable condenser and also the meanings of mmfd., uF., &c.

A.: The information you require about variable condensers has already been given in the June issue and we could not possibly repeat it all in these columns. However, "uF" and "mfd" are both short for microfarad. The terms mmfd, uufd and pf are alternatively abbreviations for micro-microfarad.

R.C.M. (Coolum-road, Qld.) writes in appreciation of the Shortwave Handbook, but enters a plea for more articles to suit readers who have no d-c power available.

A. We agree that amateurs and short-wave listeners in remote districts have not been catered for as well as they might and we have had certain twinges of conscience about it. Suitable articles are planned for the not too distant future. As for the wiring diagrams and parts lists, we agree that they are also helpful, but the preparation of a wiring diagram is always a difficult and time consuming business. Apart from that we are often pushed for space and wiring diagrams, at least, have to be omitted.

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H.S.V. (West Brunswick, Melb., Vic.) suggests that consideration be given to the publication of a circuit of an audio clipper for use with voice modulation of an amateur transmitter.

A.: Your suggestion, H.S.V., is noted. While we can make no immediate promises, considerable attention has been given to this subject in the overseas magazines usually read by the amateur fraternity. We quite agree that such devices could be, and in many cases are, being used to a great advantage in reducing the amount of adjacent-channel interference. We may publish something on this subject before very long.

H.O. (Hawthorn, Vic.) suggests that we should describe a compact 4 or 5 valve receiver using at least a 5in. loudspeaker and a loop aerial.

A. A circuit which should meet your requirements almost exactly is the "Fireside 5" described in the September, 1946, issue. Alternatively, you could construct the "Little General" using a loop aerial.

K.C. (Kew, Vic.) renews his subscription to Radio and Hobbies and says that he considers it the finest value in radio periodicals even at twice the price originally charged.

A.: Thanks for your subscription and for your encouraging remarks. We are glad to note your success with the 807 triode amplifier and note also your request for articles on signal tracers. We can make no immediate promises along this line.

R.L. (Sth. Kumminin, West. Aust.) asks how he would go about becoming a transmitting radio amateur.

A.: This licence is issued by the PMG Department after the applicant has qualified at the AOPC examinations which are normally held each quarter in the capital cities. However, arrangements can be made to be examined at official post offices in the country centres. The applicant is required to answer saisfactorily examination papers on radio receivers and transmitters and also regulations covering the operation of an amateur radio station. Last but not least he must demonstrate his ability to send and receive morse code at a speed of 14 words per minute. A syllabus setting out the scope of the examination paper is available on application to the Wireless Branch, GPO, in each capital city while specimen papers from past examinations are available from the same source at a small charge. Books recommended for study include the Admiralty Handbook and any one of the short-wave handbooks published by the ARRL, the Radio Handbook or a similar handbook published by the RSGB. If the applicant is successful in passing the AOPC examination he is then entitled to apply to the Wireless Branch for the issue of a station licence and callsign which will then entitle him to set up an amateur station. We regret, R.L., that copies of the Australian Short Wave Handbook are not now available. In regard to the information on the FS6 equipment, the journal which you mention has no connection with R. & H. Their office address, though, is Balcombe-street, Mornington, Victoria. As the equipment stands, the FS6 does not cover any of the present amateur bands and modification is necessary if it is desired to do so.

G.M.C. (Cairns, Qld.) writes an appreciation of Radio and Hobbies, but suggests that we should reduce considerably the number of advertisements in each issue.

A. Many thanks for your comments and criticism, and we hope that you are successful in obtaining your "ham ticket." Regarding the advertisements, we are certainly not in a position to reduce the proportionate space given to them. Advertising fees go a long way toward financing the production of a periodical

P.J.W. (Tarana, NSW) asks if the circuit diagram of a hearing aid is available.

A.: We have available P.J.W., circuit diagrams only of two overseas types of hearing aids. These particular aids employ valves which are not available in Australia at present, although substitution could be made with physically larger types. These circuits were published in the April, 1948, issue of R. & H. In the March, 1945, issue, we gave the circuit of a unit employing a-c type valves and operating from the a-c mains. It is essentially for use in the home and avoids the expenditure of batteries unavoidably associated with the portable type. These circuits are available through the 1/- query service.

J.L.G. (Broken Hill, S. Aus.) writes expressing agreement with the editorial in the June, 1948, issue of R. & H. He also asks a question concerning the 1941 Majestic Radiogram.

A.: Thanks, J.L.G., for the expression of your views. We were pleased to have them, even though they were in accordance with that of the editorial mentioned. It would be quite in order to use the tone control stage published in the June, 1943, issue in the 1941 Majestic Radiogram. It would need to be placed ahead of the first 6J7G, and thoroughly decoupled. Very pleased to note your satisfaction with the results with the 1941 "Super Six."

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1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.

2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."

3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."

4. Blueprints of exact size chassis layouts with all essential holes and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

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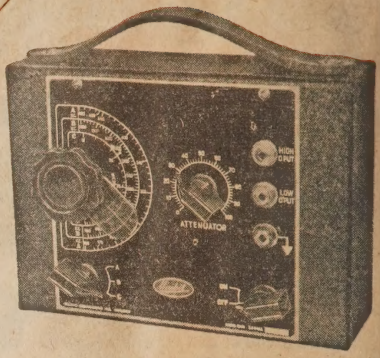

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ANSWERS TO CORRESPONDENTS

L.W.A. (Camden, NSW) writes in appreciation of Radio and Hobbies and would like to see more articles on amateur equipment in anticipation of the time when he will have his "ticket."

A.: Many thanks for your suggestions regarding the articles and it is quite possible that we will shortly be describing a transmitter along the lines you request. Articles are also in line covering the design of antennas for the ham bands. Volume compression and peak limiting are subjects which we have not yet got around to covering. We must plead ignorance of short-wave call-signs, &c., as we leave these affairs to our short-wave contributor, Mr. Ray Simpson. Any inquiries of this nature should be addressed direct to him at 80 Wilga-street, Cord West, and be accompanied by a stamped, addressed envelope. In all fairness, do not expect him to do more than supply the actual information required, if available, as he obviously cannot undertake to write lengthy letters to all correspondents. At this stage we cannot possibly undertake to handle QSL cards, especially as this activity is already looked after by the W.I.A. in each State.

H.C.E. (Natimuk, Vic.) has recently built a 1947 Advance, but is troubled with hum at low settings of the volume control.

A. In several instances we have found this trouble to be due to voltages being induced into the grid of the 6J7-G from the magnetic field of the transformer. It can be remedied by earthing the volume control terminal near the 6J7-G socket only, instead of at near the volume control. The shield on the potentiometer can be connected to the braid if not already earthed via the control spindle. This was covered by the "Serviceman Who Tells" in his article in the March issue.

J.R. (Dundee, NSW) sends in an advertisement and ask about possible causes of fading trouble in a 5V. commercial receiver.

A. The fading trouble could be caused by a valve, but you have apparently checked on all valves in your set with the exception of th e 1D5-G. Under the circumstances it would be a good idea to try to borrow another valve of this type, or a 1M5-G, which would normally operate in the same socket. Next most likely cause would be a failure in the AVC network due to a resistor being much higher in value than marked. With this in mind we suggest you check all resistors, including those in the AVC network with a multimeter. We regret that we cannot refer you to a back number of Radio and Hobbies relating to testing receivers. We can supply through the 1/- query service the circuit of a 5V. dual-wave receiver, which should meet your requirements. Alternatively, there is no reason why your pentagrid 5 should not be constructed as a dual wave set.

E.W.F.H. (Moorabbin, Vic.) asks whether it would be possible to modify a standard power transformer in such a way that it could be used in conjunction with a buzzer to provide 240 volt a-c to operate a conventional receiver.

A. The idea is feasible, but much more than an ordinary buzzer would be necessary in the primary circuit. You would have to use a vibrator capable of handling the primary current, and a full-wave input system would be desirable. Another point is that the current drain imposed by an ordinary receiver would get up around the 15 amp mark, which would very soon discharge the battery. In other words, the scheme is not a very practical one.

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Getting Started On F.M.

(Continued from Page 59)

coming signal and does not fluctuate with abrupt changes in carrier amplitude due, for example, to superimposed noise pulses.

When the signal is in resonance, as with no applied frequency modulation, the voltage across each half of the secondary is the same, and the centre tap therefore assumes a mean potential approximately equal to half the steady voltage across R2/C2. And this mean potential is likewise present across C1/R1.

The combination C1/R1 is given a time constant such that the potential across it can vary, if necessary at an audio rate, the condenser C1 being essentially an RF bypass only. In this respect it resembles the diode load of a conventional AM detector.

All this assumes that the signal frequency is in resonance with the IF channel of the receiver, and with the discriminator windings in particular.

BALANCE UPSET

The moment the frequency deviates from resonance, the balance of voltage across the two halves of the secondary is upset, a greater voltage being present in one half of the circuit than in the other. However, the total voltage across R2 and C2 is fixed, so that the net effect of the unbalance is to alter the potential at the centre-tap and therefore across R1 and C1.

Thus, as the frequency swings from one side of resonance to the other the instantaneous potential at the centre-tap varies in sympathy. This occurs at an audio rate, and the varying voltage appears across R1 as an audio signal.

The detector derives its name simply from the fact that the audio signal is produced by a varying ratio of voltage across the top half of the secondary and the top diode on the one hand, and the lower half of the secondary and the lower diode on the other. The total voltage across R2 and C2 remains the same for any given strength of carrier

NO RESPONSE TO A.M.

A burst of noise, as an amplitude modulation, can momentarily alter the current flowing through the two series diodes, but it cannot affect to any extent the steady potential across C2. And the proportion of the voltage across the audio load R1 depends still and only on the instantaneous frequency of its signal

In practice, the steady voltage across R2 can be applied readily for AVC, if such is required. For various reasons R2 is generally made about 50,000 ohms and C2 can be as high as 8 mfd., to give the necessary long time constant.

The audio load R1 can be a 0.5 megohm potentiometer, while C1 may have a capacitance approaching .01 mfd. This gives a diminishing treble response to match the rising treble response which has been accepted as standard practice in FM transmitters.

WANTED TO BUY SELL OR EXCHANGE

AS new, Radio & Television Course, £10/10/-. Cost £18. Radio Servicing Course, £15. Cost £26/10/-. **J. Mundey, Esk, Queensland.**

BACK ISSUES R & H 7½d. posted. 94 Popular Science-Mechanics. What offers? Exchange 240-110 volt Tranny for 240-12 volt. Stamp for list. **Gus Durham, Mount St., Blayney, N.S.W.**

EXCHANGE: Radio & Hobbies, good condition, January, 1944, to this issue, April and May, 1944 missing, for any type a.c. mantel receiver, slight disorder no objection, or best offer in the following valves, 42, 75, 78, 6A7. **E. Davies, 36 Ethel Street., Carlton, N.S.W.**

FOR quick sale, valves as new at 12/- each. 6SA7, 6SL7, 6SR7, 6SC7, 6L7, 6C8G, 6K7, 6J7, 6N7, 6C5, 6J5, 6H6, 6F6, 6F7, 6A6, 6V6, 1D8GT, 1H5G, 1Q5G, 1M5G, 1629, 12A6, 12K8, 12SK7, 12AH7, EL3NG, EBF2, 6X6. Add postage. **R. Milner, Verney St., Sandgate, Queensland.**

FOR SALE: 50 watt transmitter Commercial Appearance, cost £38 in parts, sell £38 (photo, etc., supplied), Kingsley KCR11 receiver, perfect, £40. List other parts for sale, cheap. **Cecil Williamson, Yass.**

FOR SALE: Brand new Thornton-Manchester drafting set. Has not been used. Want £6, but will accept best offer. Cost £8. Write only, **R. Gordon, c/o N. Kidd, 311 Coventry Street, South Melbourne, Victoria.**

FOR SALE: A.S.V. Rec. with 5PB1, 6 1852's, 2 6H6's, 300 Mill P.T., 2 250 Mill D.C's.; 60 copies of "R. & H.," from Feb., '41. **D. Parrington, 148 Domain Street, South Yarra, S.E.1.**

FOR SALE: Aegis "Little Companion" Set, £15. Calstan multi-meter model 331 (new), £7/10/-. "Pacific Motuiti" Steel Guitar in case (as new), £11. **L. E. Schilg, Tinamba, Victoria.**

FOR SALE: Aegis "Little Companion" 4/5 dual-wave mantel. Excellent performer in lovely walnut cabinet. New, £20. **R. Rolland, 1 City View Rd., E.9. Victoria.**

FOR SALE: 1947 "Pentagrid Five," complete with valves and speaker, for use with batteries or 6v. vibrator, £15/10/-. **Marshall, 16 Marlow Avenue, W. Ryde.**

FOR SALE: R & H Vol. 1, No. 7 up to date, complete, except Vol 2, No. 1. 108 issues. £5/10/-. **W. E. Cohn, 351 Beamish St., Campsie, N.S.W.**

FOR SALE: Radiogram chassis, D/W 9 valve P/P 6V6G output, complete with 12in. amp speaker, new, £30. **14 Second Avenue, Carlingford.**

FOR SALE: Every volume, Radio & Hobbies, from 1st edition up to present. Best offer. Write **A. Henderson,** 16 French St., North Sydney.

FOR SALE: Min-vox radio, complete with cabinet, £8 or best offer. **D. Armstrong, Greendale Street, Greenwich.**

FOR SALE: Ham receiver, 10-20-40 plug in coils, 8 tubes, pwr supply speaker, etc., £20. **14 Second Avenue Carlingford.**

FOR SALE: Multimeter D.C., using Calstan model 331 meter. Good condition. £4/10/-. **A. G. Loveday, Elimbah, Q.**

R. & H., No. 1, Vol. 1, to No. 6, Vol 10, complete except August, '42. Best offer. **A. Hartog, 60 Percival Street, Bexley, N.S.W.**

SELL: 6 valve 1.4 broadcast portable radio of a R & H circuit with an RF stage and 2/1Q5GT/s in parallel output. 6" Rola PM speaker. Leatherette case, rubber feet. Heavy duty batteries affixed inside the case. Strong volume, beautiful tone and in excellent order. Owner has no further use for it. Price at £22. **H. L. Ingleby, 2 Kendall St., Essendon, W5. Victoria.**

SELL: A.W.A. 3B.Z. Communication Receiver, 240v. 200 K.C.—30 M.C. New. £37/10/-. Also 8-4 gang A.W.A. conds., Marconi V.H.F. wave meter and osc., 155-230 M.C., Marconi D/F receiver, 40 K.C.-1000 K.C., 8 valve, 8 M.F. conds., 450v. work, 4/- ea. Other radio parts. **170 Dunning Avenue, Rosebery.**

SALE: BC 348 Communications Receiver, £40. **C. Everdell, Box 67, Atherton, NQ.**

SELL or EXCHANGE: Valves 2B7, 6Q7X2, 6K7X2, 6D6X2, B240, 6V6X2, 6F3X2, 247, 6F6X3, C243, 6SJ7, E443H, 1D5GP, 30 31X2, 32X2, 34, 42, 1C4, 45, 56, 57, 5V4, 71A, 75, 5Y3, E406N, 6G6, 6A6, 6A7, 6B6, 6F7, 6F8. Will swap for 12v. Gramo motor. **H. Brooks 191 Dugan St., Kalgoorlie, W.A.**

SALE: Christmas Presents! Vanguard 1-3 h.p. model Petrol Engine, suit speed-boat or aeroplane. Originally £21/10/-; 20in. Racing Yacht, professionally built, hollowed cedar hull, 4 Japara silk sails. Originally £9. What Offers? **L. Kelly, Granville Ter., Kedron, Brisbane.**

SALE: Little Jim, complete with new batteries and polished cabinet, £5/10/-, with phones. **K. Power, 5 Enmondson Street, Wagga. N.S.W.**

SELL: Palec valve circuit tester, model VCT. New. Receipt to verify perfect order. Price £21. Apply **189 Walker Street, Redfern.**

SELL: Pick-up, Wilkins & Wright, Type N, moving coil, ½ oz. pressure, equaliser and transformer, complete, new, £6. **W. M. Hale, Anglesea, Victoria.**

SELL: 4 stage triple wave unit, 4 gang condenser with dial glass to suit, £5/15/- the lot. **R. Bedford, 29 Emily St., Murrumbeena, Victoria.**

SELL: Complete 5 band coil kit for R & H mod. osc., £1. **F. R. Scambary, Pennant St., Castle Hill, New South Wales.**

SELL: 8 mm Kodak model 20 movie camera, £25. **Doherty, 109 Oaks Avenue, Dee Why.**

SALE: Amateurs' radio gear, valves, chokes, condensers, instruments, spkrs., going cheap. **85 Sixth Avenue, Lidcombe.**

WANTED: Copies of R. & H., January, Februay, March, August, September, 1942; January, July, 1943; April, 1944. Also Radio News, October, November, 1946, and Circuit C.V.R./52233 and 832 Tube. **Bridge, 194 Albert Road, South Melbourne, Victoria.**

WANTED TO BUY: AR88 communications receiver in good order and condition. Write **S. E. Widgery, 703 Macarthur St., Ballarat, Victoria.**

WANTED: December, 1945 and February, 1946 of Radio & Hobbies. **T. P. Kelly, Australia Hotel, McGrath's Hill, Windsor.**

WANTED: Record player, 5 watt amplifier unit, also 35 mm enlarger. **F. Doherty, 109 Oaks Ave., Dee Why. XW7053.**

WANTED to Buy: G12 Speaker with 10,000 ohm transformer, centre tapped. **L. J. Pare, Dover, Tasmania.**

WANTED: Dry metal rectifier, six volt three amp and 12 volt two amp. **H. Fuller, Box 101 Warrnambool, Victoria.**

WANTED TO BUY: BC 348 or similar, also AR8. **L. H. Duncan, 16 King Street, Gawler, Sth. Australia.**

WANTED: S.H. copy Ghirardi Radio & Physics C. Also 12 issues 1942 Radio & Hobbies. **26 Knox St., Randwick.**

WANTED: A.R.8 Receiver. State price, condition. **H. J. Weatherley, Clifton, Queensland.**

CLEARANCE SALE OF A FEW LINES.

Torpedo Microphones, New, £5 ea. (ten only). Ellipsoid Microphones, New, £3/4/- ea. (twelve only). Slightly used Microphones also for sale. Type "E" Garrard Turntables and Pickups, complete with pickup, New, £5/14/6 ea. (eight only). **STEANE'S Sound Systems Pty. Ltd., 367 Kent St., Sydney. MA2588, M3136.**

MODELS Technical Engineering Supplies, Castings and Blue Prints. New Enlarged Catalogue, 1/6. **O. Bolton, Room 1, 70 King Street, Sydney.**

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